SIDA CONTRIBUTIONS TO BOTANY

Volume 5

1972 — 1974

SIDA Contributions to Botany volume 5 (in 5 numbers)

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by Wm. F. Mahler

SMU Herbarium

Dallas, Texas 75275

DATES OF PUBLICATION

No. 1, pp. 1—58: 24 Mar. 1972

No. 2, pp. 59—136: 30 May 1973

No. 3, pp. 137—190: 18 Jan. 1974

No. 4, pp. 191—300: 29 July 1974

No. 5, pp. 301—354: 11 Feb. 1975

Index, pp. 355—361

For contents, see the unnumbered pages forming the front covers of the separate issues.

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SIDA, founded by Lloyd H. Shinners, is privately published by Wm. F. Mahler, SMU Herbarium, Dallas, Texas, 75222, U. S. A. Subscription price $8 (U.S.) per volume; parts issued at irregular intervals.

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A RECONSIDERATION OF THE CORRECT NAME FOR THE HAWAIIAN GOSSYPIUM.

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Wilbur (1964) proposed rejection of the name *Gossypium tomentosum* Nutt. ex Seem. for the native Hawaiian cotton, and acceptance of the next oldest valid name, *G. sandvicense* Parl. His basis for the rejection of Seemann's (1865) name is that Seemann's original conception of the species was too broad, encompassing plants both from Hawaii, where the species in question occurs, and from Fiji, where it does not.

Wilbur clearly documents the fact that Seemann's description is heterogeneous, as Watt (1907) had noted earlier, and that it was derived both from Hawaiian specimens of *G. tomentosum* and from Fijian specimens that have been described under the name *G. taitense* Parl., but which are now generally included in *G. hirsutum* L. Wilbur thereupon attempted to lectotypify Seemann's name by circumscription: he stated that "*G. tomentosum* must be typified by the plants principally characterized by the publishing author. . . ." He then expressed the opinion that the description is more heavily weighted toward the Fijian element than the Hawaiian element, stating that "it is readily apparent that the greater portion of Seemann's original diagnosis can apply only to the Fijian cotton." His opinion is surely subject to challenge. One could, for example, note that Seemann cited three specimens from Fiji (Smythe, Pritchard, and Seemann) and four specimens from Hawaii (Diell, Nelson, Menzies, and Nuttall) as well as a specimen of Trove "from Joynegau" which Watt (1907, p. 129) indicates is a specimen of Hove "from Joynegare" (=Junagadh, Kathiawar), located in western India. On such a basis, one might equally well conclude that the Hawaiian element rather than the Fijian element "predominated" in Seemann's conception of the species.

More to the point, perhaps, is a re-examination of Seemann's description and Wilbur's analysis of it. Wilbur notes three items (stipules, bract teeth, and seed hairs) that favor the Fijian element in Seemann's description and only one (calyx form) that favors the Hawaiian. I agree with Wilbur's interpretation of bract teeth, seed hairs, and calyx form, but not that of the stipules. (I do not believe any conclusion can be reached for this item, because of the variability in these plants of the stipules, which differ in vegetative and reproductive branches. Apparently neither Seemann nor Wilbur was aware of this fact, and the descriptive terminology employed does not permit any conclusion to be reached concerning the origin of the specimens whose stipules Seemann described.) Moreover, Wilbur overlooked two items (corolla color and indumentum) that tend

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to favor the Hawaiian element. Therefore, one cannot conclude that either the Fijian or the Hawaiian element "predominated" in Seemann's description, but only that the description is indeed composite. Wilbur also failed to consider the extent to which the description might have been based upon Hove's plant from India.

However, such attempts to express a value judgement are beside the point. The problem of the correct application of the name *G. tomentosum* is to be resolved on the basis of typification. Wilbur rightly emphasized the importance of lectotypification in resolving this question, but curiously failed to choose a lectotype.

I designate Nuttall's specimen, bearing his manuscript name and kept at the British Museum (Natural History), as the lectotype of *Gossypium tomentosum* Nutt. ex Seem. Nuttall's specimen is the one from which Seemann took the name, and it may be viewed as the "holotype" of Nuttall's unpublished name, which Seemann subsequently published. It therefore seems the most appropriate choice as lectotype of Seemann's name. Such a choice preserves established usage. I see no advantage to a lectotypification that upsets established usage and is therefore contrary to Recommendation 7B of the Code, as was suggested (although not done) by Wilbur. That Seemann included Fijian and Indian material in his citation of specimens and utilized them to a degree in drafting his description, was simply a taxonomic error on his part that need not deflect us from making a correct nomenclatural decision. The problem is indeed resolved by a satisfactory typification.

The name that Wilbur concluded was the correct one for the Hawaiian endemic, *G. sandvicense* Parl. (Parlatore, 1866), was published one year later than *G. tomentosum*, and is thus to be relegated to synonymy under the latter name, as most authors have done. Parlatore's name has evidently never been typified, and so I will take this opportunity to rectify that omission. Parlatore cites specimens of Forster, Menzies, and Nuttall (the last-named cited with a question mark) following his description of the species, all collected in the Sandwich Islands (i.e., Hawaii). Only Menzies' specimen is cited with an exclamation point (the usual indication that a specimen was actually examined) and mentioned in the subsequent discussion. Therefore, I designate Menzies' specimen as lectotype of *Gossypium sandvicense* Parl. That the same specimen was cited by Seemann, underscores the synonymy noted above. Aliotta (1903) notes the lectotype to be in the "Erbario Centrale Italiano" in Florence (FI).

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CHROMOSOME NUMBERS IN PHYSALIS AND SOLANUM (SOLANACEAE)[1]

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While conducting a chromosomal survey of *Chamaesaracha,* meiotic materials of several other Solanaceous taxa were collected from a wide area of the southwestern United States and northern Mexico. Chromosome counts obtained from this material are reported in Table I.

Techniques for producing pollen mother cell squashes essentially follow those presented by Turner and Johnston (1961). Voucher specimens are deposited in the herbaria of The University of Texas, Austin, and Sul Ross State University. We are grateful to Dr. U. T. Waterfall for the identification of many of the Mexican species of *Physalis*.

Table I. Species of *Physalis* and *Solanum* examined for chromosome number.

Taxon	*Chromosome number (n)*	*Vouchers*
PHYSALIS:		
P. crassifolia Benth. var. *crassifolia*	12	MEXICO: B.C.S. 67 mi N of Villa Constitution. *Sikes and Babcock 280a,b,c.*
	12	MEXICO: B.C.S. 2 mi N of San Antonio. *Sikes and Babcock 266.*
	12	MEXICO: B.C.N. 27 mi NE of San Felipe-Rosario Junction. *Sikes and Babcock 307.*
P. crassifolia Benth. var. *infundibularis* I.M. Johnst.	12	MEXICO: B.C.N. 7 mi NE of San Felipe-Rosario Junction. *Sikes and Babcock 305.*
**P. glabra* Benth.	12	MEXICO: B.C.S. 7 mi W of La Palmilla. *Sikes and Babcock 242.*
**P. glutinosa* Schlect. var. *glutinosa*	12	MEXICO: Durango. 4 mi W of Durango. *Sikes and Babcock 375.*
P. hederaefolia Gray var. *cordifolia* (Gray) Waterfall	12	NEW MEXICO: Otero Co. 29 mi SE of Cloudcroft. *Sikes 69.*
	12	ARIZONA: Yavapai Co. 38 mi S of Flagstaff. *Tomb 272.*
**P. hederaefolia* Gray var. *hederaefolia*	12	TEXAS: Brewster Co. 6 mi S of Alpine. *Averett 126.*

[1] Aided in part by National Science Foundation Training Grant GB-6914.
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	12	TEXAS: Brewster Co. 13 mi S of Alpine. *Averett 111.*
	12	TEXAS: Brewster Co. 6 mi S of Alpine. *Boston 29.*
	12	MEXICO: Durango. 15 mi N of La Zarca Junction on Mex 45. *Sikes and Babcock 364.*
P. lobata Torrey	12	TEXAS: Brewster Co. 16 mi E of Alpine. *Averett 84.*
	11	TEXAS: Ector Co. 10 mi N of Odessa. *Watson 139.*
	11	TEXAS: Ector Co. 14 mi S of Odessa. *Watson 191.*
	11	TEXAS: Pecos Co. 18-24 mi W of Bakersfield. *Tomb 414.*
	11	TEXAS: Pecos Co. 21 mi E of Ft. Stockton. *Tomb and Bierner 430.*
	11	TEXAS: Presidio Co. 11 mi N of Presidio. *Sikes and Averett 139.*
	11	TEXAS: Val Verde Co. 1 mi E of Langtry. *Averett 283.*
	11	TEXAS: Val Verde Co. E city limits of Del Rio. *Tomb 402.*
	11	TEXAS: Terrell Co. 3/4 mi W of Dryden. *Averett 277.*
	11	NEW MEXICO: Chaves Co. 13 mi W of Roswell. *Averett and Tomb 330.*
	11	NEW MEXICO: Grant Co. 9 mi W of Hachita on N. Mex #9. *Tomb and Bierner 441.*
	11	MEXICO: Chihuahua. 26 mi NE of Carmargo. *Sikes and Patterson 406.*
	22	NEW MEXICO: Lea Co. 1 mi W of Broncho. *Averett and Tomb 321.*
	22	NEW MEXICO: Union Co. 18 mi W of Clayton. *Tomb 538.*
	22	OKLAHOMA: Cimarron Co. 12 mi S of Campo, Colorado. *Tomb 342.*
	22	TEXAS: Concho Co. 3 mi S of Runnels county line on hwy. 83. *Averett and Bierner 484.*
	22	TEXAS: Hardeman Co. 3 mi S of Quanah. *Averett and Bierner 477.*
	22	TEXAS: Jones Co. 3 mi S of Stamford. *Averett and Bierner 479.*
	22	TEXAS: Lubbock Co. 11 mi N of Lubbock. *Averett and Tomb 355a.*
	22	TEXAS: Young Co. Olney, Texas. *Seigler 1469.*
	22	MEXICO: Coahuila. 43 mi NW of Muzquiz. *Powell and Patterson 1586.*
**P. sordida* Fernald	12	MEXICO: Sinaloa. 3 mi N of Mazatlan. *Sikes and Babcock 200.*

**P. vestita* Waterfall	12	MEXICO: Sinaloa. 6 mi N of Mazatlan. *Sikes and Babcock 202.*
P. viscosa L. var. *cinerascens* (Dunal) Waterfall	12	TEXAS: Bee Co. N side of Beeville. *Tomb 354.*
	12	TEXAS: Ector Co. 14 mi S of Odessa. *Watson 190.*
	12	TEXAS: Jeff Davis Co. 26 mi W of Toyahville. *Sikes 349.*
P. wrightii Gray	12	ARIZONA: Pinal Co. 39 mi S of Phoenix. *Averett and Watson 411.*
	12	ARIZONA: Pinal Co. 30 mi S of Phoenix. *Averett and Watson 412.*
SOLANUM:		
**S. amazonicum* Ker.	12	MEXICO: Sonora. 1 mi E of Navajoa. *Sikes and Babcock 184.*
S. eleagnifolium Cav.	12	TEXAS: Brewster Co. 6 mi SW of Marathon. *Watson 18.*
	12	TEXAS: Hudspeth Co. 1 mi W of Sierra Blanca. *Sikes 60a.*
	12	TEXAS: Hudspeth Co. 1 mi W of Sierra Blanca. *Sikes 60b.*
	12	TEXAS: Jeff Davis Co. 24 mi NW of Ft. Davis. *Boston 11.*
	12	NEW MEXICO: Hidalgo Co. 17 mi W of Lordsburg. *Averett and Watson 383.*
**S. hindsianum* Benth.	12	MEXICO: B.C.S. 1 mi N of Villa Constitution. *Sikes and Babcock 253.*
**S. madrense* Fernald	12	MEXICO: Sinaloa. 70 mi S of Mazatlan. *Sikes and Babcock 208.*
S. nigrum L.	12	ARIZONA: Cochise Co. 24 mi W of E entrance to Chiricahua Nat'l. Monument. *Averett and Watson 392.*
	12	ARIZONA: Greenlee Co. 12 mi W of Mule Creek, N. Mex. *Averett and Watson 435.*
	12	ARIZONA: Santa Cruz Co. Madera Canyon. *Averett and Watson 408.*
	12	NEW MEXICO: Chaves Co. 43 mi SE of Cloudcroft. *Sikes 71.*
	12	NEW MEXICO: Hidalgo Co. 10 mi S of I-10 on U.S. 80. *Averett and Watson 384.*
	12	TEXAS: Jeff Davis Co. 1 mi E of Boy Scout Camp. *Sikes 345.*
	12	TEXAS: Presidio Co. Pinto Canyon. *Sikes 82.*
	12	TEXAS: San Patricio Co. Lake Corpus Christi State Park. *Tomb 359.*
S. rostratum Dunal	12	TEXAS: Brewster Co. 21 mi E of Alpine. *Watson 63.*

**S. triflorum* Nutt.	12	UTAH: Beaver Co. 12 mi E of Milford. *Averett and Watson 421.*

* First report for the taxon.

DISCUSSION

Excepting $n = 11$ in *P. lobata* (= *Quincula lobata* (Torr.) Raf.), chromosome numbers presented for the 18 taxa of *Physalis* and *Solanum* are on a base of $x = 12$. Initial counts are reported for nine taxa which are denoted by an asterisk in Table I. Most of the species examined are diploid ($n = 12,11$), substantiating the rarity of polyploidy in *Physalis, Solanum,* and related genera. In the Solanae, *Chamaesaracha* alone displays considerable polyploidy (Powell and Averett, 1967).

Some elaboration is appropriate with regard to the occurrence of diploid and tetraploid races in *P. lobata* (Table I.). Menzel (1950) observed that three seed classes (based on size) of this species are correlated with fairly distinct geographic ranges. As seen in Figure 1, class I (2.7-3.0 mm) extends from central Texas north into Kansas, Colorado, and New Mexico. Class II (1.8-2.2 mm) is largely restricted to southern and western regions of Texas and adjacent Mexico. Class III (3.8-4.0 mm) is limited to southern Arizona. Based upon counts from one tetraploid and four diploid populations, Menzel further correlated seed sizes with chromosome numbers in classes I and II, representing the $4n$ and $2n$ populations respectively. A still higher ploidy level was thought to characterize class III. The counts reported in Table I generally adhere to the geographic ranges for the diploid and tetraploid races suggested by Menzel (Figure 1). No chromosome counts are available from southern Arizona (class III).

Menzel (1950) also noted a few herbarium specimens with large seeds within the range of the small-seeded populations and *vice versa.* Chromosome counts for these mixed populations are lacking, but a tetraploid count for *P. lobata* was obtained from specimens collected in northern Mexico, well within the diploid range of the species (Figure 1).

An autoploid origin is suspected for the tetraploid race of *P. lobata.* Morphologically the tetraploids are nearly identical to the diploids, and there is no indication that other species have been involved in their origin. Although segmental allopolyploidy is possible, Lewis (1967) has pointed out that it is not necessary to postulate a hybrid origin between ecologically distinct populations in order to account for the establishment and maintenance of discrete polyploid populations. In any case, even considering alloploidy, the tetraploid race presumably arose in desert areas of the southwestern United States and northern Mexico, and subsequently spread into the grassland areas to the north.

Menzel (1950) concluded that the $n = 11$ in *P. lobata* was derived from $n = 12$ by aneuploid loss. The existence of $n = 12$ in this taxon could be offered to support this conjecture. However, the extra chromosome could have resulted through aneuploid gain.

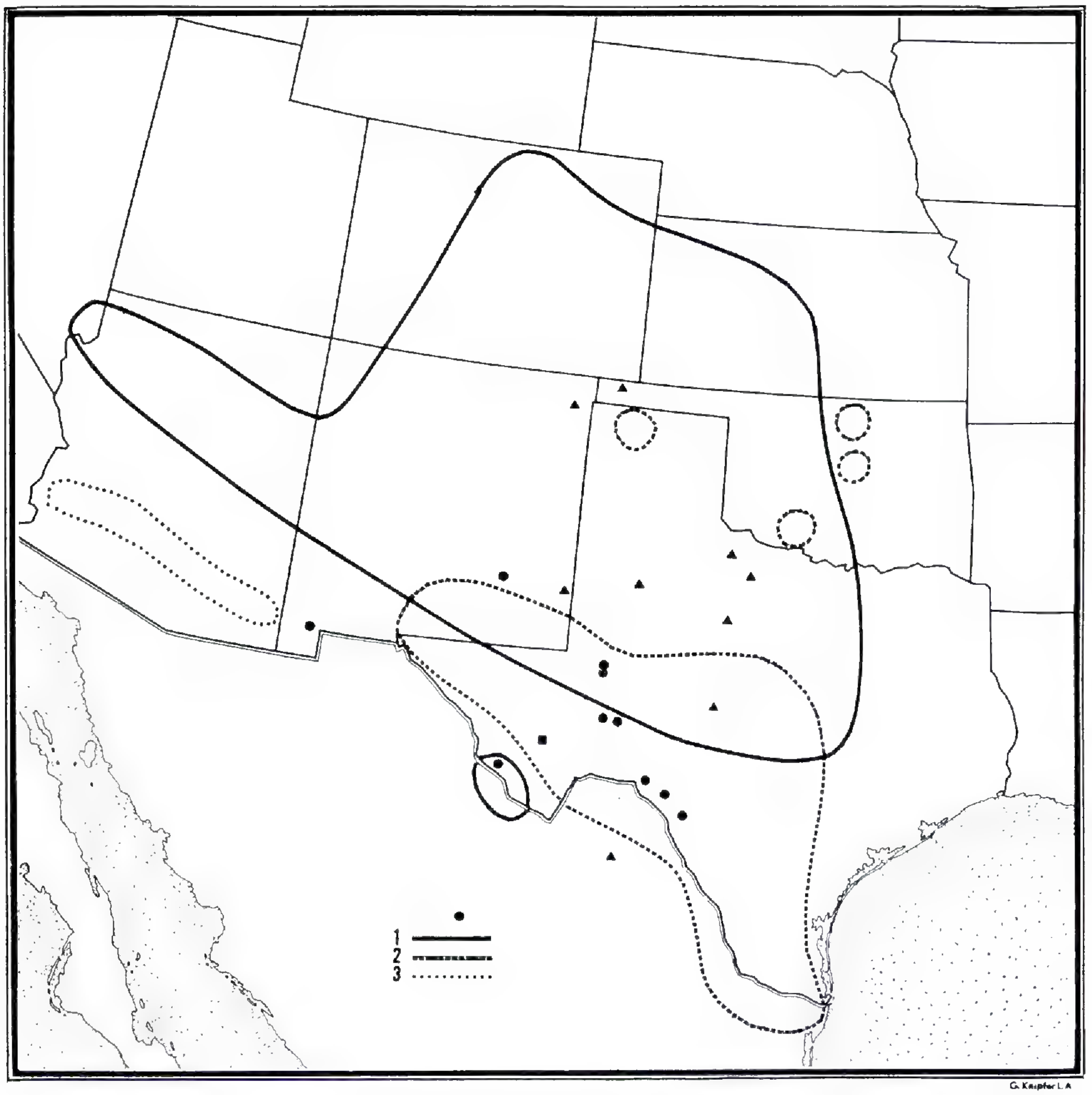

Fig. 1. Distribution of tetraploid and diploid *Physalis lobata*; triangles ($n = 22$), circles ($n = 11$), and squares ($n = 12$). The distribution of three classes of seed sizes recognized by Menzel (1950) is also shown; 1 (2.7-3.0 mm), 2 (1.8-2.2 mm), and 3 (3.8-4.0). Discussion in text.

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A REVISION OF THE GENUS POLIOMINTHA (LABIATAE)

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Poliomintha (Labiatae) is a small North American genus whose four shrubby species inhabit the arid regions of the southwestern United States and northern Mexico. Bearing only two fertile stamens in combination with a tubular calyx, it is placed in the subtribe Melissinae, a heterogeneous group long recognized as taxonomically difficult. The two-stamen genera within the Melissinae, including *Poliomintha*, merge imperceptibly into one another and provide considerable difficulty in their definition. In addition, their morphological affinities with the four-stamen genera *Melissa* and *Satureja* open the question of unnaturalness within the subtribe and the taxonomic weight accorded stamen number. As pointed out by Epling & Stewart (1939) it is entirely possible that there has been extensive parallelism and convergence with the abortion of the upper stamen pair occurring repeatedly within the four-stamen groups. Indeed, one member of the Melissinae, *Pogogyne*, was revised to include both two- and four-stamen species (Howell, 1931).

The present study, which stems from preparations for the *Flora of Texas*, attempts to examine closely the generic status and relationships of *Poliomintha* as well as to bring needed insight into its morphology, distribution, and possibly phylogeny. It was originally hoped that the small number of species in the genus would permit breeding and chromosome studies. Unfortunately, repeated attempts at such studies over a number of years were successful with only one species, *P. longiflora*.

HISTORICAL ACCOUNT

The genus *Poliomintha* was created by Gray in 1870 to accommodate two species, *P. longiflora* and *P. incana*, the latter serving as the type. It should be noted, however, that informal recognition of the group came 11 years earlier with Torrey's description of *Hedeoma incanum* in 1859. Regarding the disposition of his new species, he stated, "It may remain in *Hedeoma* for the present, but, if other species like it should be found, it may be the type of a new genus." Between 1870 and 1890 three species were added (*P. bicolor*, *P. marifolia*, and *P. glabrescens*). In 1897, with Briquet's treatment of the Labiatae in *Die Natürlichen Pflanzenfamilien*, *Poliomintha* was merged with *Hedeoma*, reflecting the inherent difficulties in the disposition of the taxa. With the work of Epling & Stewart (1939), generic status was again given *Poliomintha*; in addition, the sections *Incanae* and *Saturejoides* were informally established. *Poliomintha conjunctrix* was added in 1940, bringing the genus to its current number of four species.

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CHROMOSOME STUDY

The chromosome numbers recorded to date from the subtribe Melissinae seem to reflect current concepts of monophyletic units; moreover, both number and morphology may be valuable criteria in segregating related genera (Irving, 1968). Unfortunately, only a few representative species of five of the 11 genera of Melissinae have been counted. The first count for *Poliomintha*, $2n = 36$, was made from aceto-carmine squashes of seed root-tips of *P. longiflora* Gray: MEXICO. NUEVO LEON. Calcareous hills near Monterrey, *Irving 698* (MONTU, TEX).

The number suggests a separation of *Poliomintha* from several possibly related groups. For example, the single species counted for *Hesperozygis*, *H. marifolia* ($2n = 44$; Irving, unpublished), has been extremely difficult to treat as it shows affinities to both *Poliomintha* and *Hedeoma*. The chromosome number $2n = 36$ for *Poliomintha* tentatively suggests a separation of *Poliomintha* and *H. marifolia*.

The chromosome numbers of the four-stamen genera *Melissa* and *Satureja* are diverse ($2n = 18, 20, 22, 30, 32, 42, 45, 48$; Darlington & Wylie, 1955; Cave, 1965; Ornduff, 1967, 1968, 1969), but as yet $2n = 36$ species have not been encountered. Needless to say, additional chromosome numbers are needed for all these groups before conclusive relationships can be ascertained.

The chromosomes of *P. longiflora*, which average 3 microns in length, are large compared to those of *Hedeoma* or *Hesperozygis* (Irving, 1968). Moreover, they are primarily metacentric or submetacentric. With additional work these size and structural differences may prove useful in distinguishing and relating these taxa.

GENERIC LIMITS AND RELATIONSHIPS

On the basis of the present understanding of morphology, ecology, and distribution, *Poliomintha* is believed to be a natural group that is most likely monophyletic in origin. The question of its disposition remains. If it is argued that genera are to be recognized on the basis of clearcut and nonintergrading characters, then *Poliomintha* cannot be maintained as a distinct genus and should be merged with *Hedeoma*. With the application of this view, however, consistency in concept would demand that all 11 of the two-stamen genera of the Melissinae be brought together into one polymorphic genus. The distinctness of the characters used to separate *Poliomintha* from its closest ally, *Hedeoma*, are equal to those used to separate the remaining genera. This is approximately the rationale of Briquet (1897), who expanded *Hedeoma* to include most of these genera. This position, although logical, results in a taxon dissatisfying from several standpoints. Its resulting diversity of form would preclude meaningful generic characterization; indeed, there would remain but one character, the two stamens, to unify and distinguish the group. Equally important, such a taxon would severely obscure many evolutionary trends; quite likely the resulting genus would be partly horizontal in aspect, cutting across several

phyletic lines. Fortunately, however, it is well understood that the course of evolution does not permit application of *a priori* rules in the disposition of taxonomic rank. Each group must evolve its own generic and specific criteria. Thus, I have used the combination of subtle characters which do distinguish *Poliomintha* to accord it generic status.

Poliomintha is related to several sub-groups in the four-stamen genus *Satureja*, especially the shrubby section *Guardoquia*. The obvious difference between these groups is the number of stamens, but there are others. The canescent and shrubby habit and the symmetrical calyx can be found throughout the genus *Satureja*, but they occur together only in *Poliomintha*. The chromosome number of *Poliomintha*, when more completely known, may represent another possible difference.

Within the two-stamen groups, three genera need to be considered: *Zizophora, Hesperozygis*, and *Hedeoma*. For those seemingly more distantly related see Epling & Stewart (1939). *Zizophora* is a Mediterranean group whose morphological attributes are surprisingly similar to *Poliomintha*. One of the latter's most salient features is a radially symmetrical calyx whose subequal, deltoid teeth close the orifice at maturity. Another characteristic is its canescent pubescence. All three of these features are found consistently in *Zizophora*. The slight differences include the abortion of the lower anther sacs and the non-shrubby habit of *Zizophora*. The continental separation of *Poliomintha* and *Zizophora* is, however, a clear-cut difference. Unfortunately, the chromosome number(s) of *Zizophora* is unknown.

Poliomintha and the primarily South American genus *Hesperozygis* are relatively distinct except for the somewhat ambiguous species *H. marifolia* (2n = 44) of Mexico. The latter possesses the habit of *Poliomintha*, a calyx intermediate between the two genera, and the calyx annulus of more typical *Hesperozygis*. The differences between *Poliomintha* and the remainder of the genus *Hesperozygis* are tabulated below.

Hesperozygis	*Poliomintha*
Calyx either symmetrical and campanulate or bilabiate.	Calyx symmetrical, tubular.
Calyx teeth subequal, erect or disposed into upper and lower sets.	Calyx teeth subequal, inwardly reflexed to close the orifice.
Calyx annulus well defined and usually seated below the base of the teeth.	Calyx annulus absent or irregular and seated at the base of the teeth.
Corolla tube hirtellous.	Corolla tube annulate.
Principally South American.	Exclusively North American.
$2n = 44$ (one count).	$2n = 36$ (one count).

The genera *Hedeoma* and *Poliomintha* are quite close and nearly "connected" by several transitional species: *H. palmeri, H. molle*, and *H. montanum*. Although Epling & Stewart (1939) mention a few distinguishing

features, several more have been encountered which in combination separate the two genera. These are tabulated below.

Hedeoma	*Poliomintha*
Occasionally semishrubs, usually herbaceous perennials or annuals.	Shrubs.
Calyx tube gibbous or saccate.	Calyx tubular and symmetrical.
Calyx teeth usually acuminate and well differentiated into upper and lower sets.	Calyx teeth subequal, convergent to close the orifice.
Calyx annulus in a well-defined ring.	Calyx annulus absent or in an irregular ring.
Nutlets oblong or orbicular in outline, ca. 1.5 mm long or less, usually becoming mucilaginous when moistened.	Nutlets oblong, over 1.5 mm long, not becoming mucilaginous when moistened.
$2n = 34, 36, 44, 72, 144$.	$2n = 36$.

PHYLOGENETIC CONSIDERATIONS

To speculate on the intra- and inter-phyletic relationships of *Poliomintha* in the face of experimental ignorance is indeed tenuous. Yet as chromosomal morphology, populational dynamics, and other clues into evolutionary behavior are likely to remain undetermined for some time, the presentation of a tentative phyletic picture is, perhaps, not altogether out of place.

Poliomintha appears to represent an older phylad whose populations have experienced dissection and extinction with evolutionary time. Its shrubby habit, cylindrical, symmetrical calyx tube, undifferentiated calyx teeth, large corollas, and allogamous breeding behavior are all primitive features within the subtribe Melissinae as judged from the study of several other genera. Morphological transitions between taxa, often a salient feature of youthful and evolutionary active phylads, are conspicuously absent in *Poliomintha*. Although interpopulational variation occurs, the specific criteria remain intact. The complete allopatrism of its species also hints at long evolutionary divergence. By comparison, the species of the related genus *Hedeoma* are often annuals with highly zygomorphic calyces and cleistogamy. Its species frequently intergrade one into another, and as many as five species may grow sympatrically. In addition, the frequent occurrence of aneuploidy reinforces the more derived status of *Hedeoma*. (Irving, 1968.)

Poliomintha has diverged along two lines, representing the subgeneric groupings *Saturejoides* and *Poliomintha*. Yet the two lines display interesting parallelisms following their divergence. Both reveal identical shifts in inflorescence, corolla morphology, habitat, and distribution accompanying speciation from the "primitive" types.

Poliomintha longiflora (Saturejoides) ranges along the eastern periphery

of the Chihuahuan Desert from Monterrey southward to San Luis Potosí (Fig. 1). Its populations are found disjunctively on open exposed sites in the foothills flanking the Sierra Madre. It is most often associated with *Juniperus monticola* and *Agave lecheguilla* in an ecotone region between mesquite grassland and pine-oak forest. Morphologically it is well marked

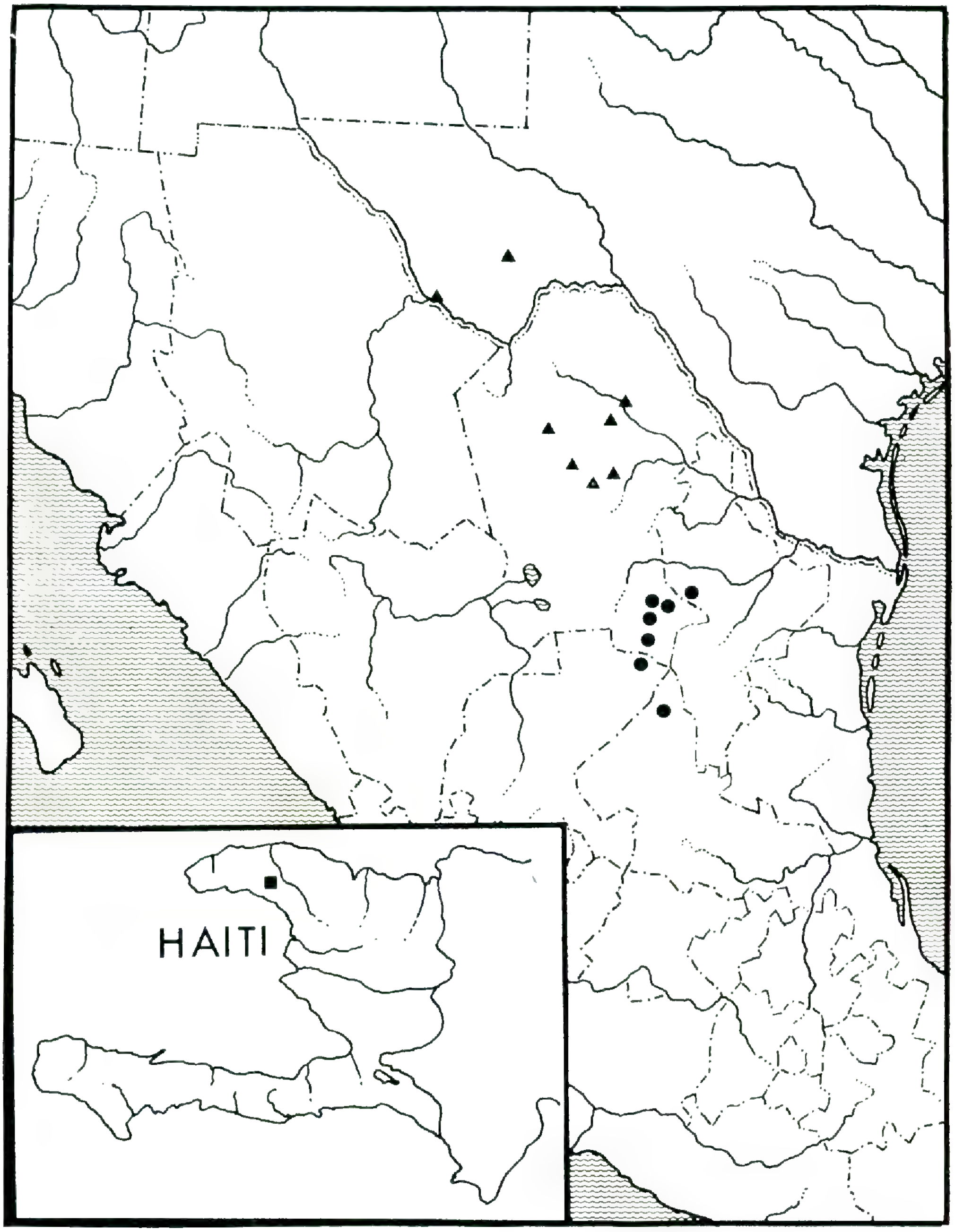

Fig. 1. Distribution of *Poliomintha longiflora* var. *longiflora* (circles), *P. longiflora* var. *congesta* (squares), and *P. glabrescens (triangles).*

by solitary flowers and large red corollas. The allied species *P. glabrescens* is found to the north of *P. longiflora* in the Chihuahuan Desert and in low xeric habitats. Although *P. glabrescens* is very similar to *P. longiflora* it possesses an inflorescence of 6-flowered cymes and bears small white corollas. *Poliomintha glabrescens* thus may be viewed as derived.

Section *Poliomintha* reveals a similar pattern with *P. conjunctrix* representing the relatively "primitive" mesophytic element. *Poliomintha conjunctrix* is known today only from a single population in the chaparral of northern Baja California (Fig. 2). It has a 3-flowered inflorescence with long red tubular corollas. In contrast, *P. incana* is a widespread, more northern species occupying extreme xerophytic sites in the lower Great Basin and western Chihuahuan Desert (Fig. 2). It possesses 6-flowered cymes and small white corollas.

By superimposing knowledge of the distribution, ecology, and morphology of *Poliomintha* on the presently known events of the Tertiary, a chronological evolutionary history can be formulated. Although this formulation is speculative, it provides the rationale for the existing relationships within the genus and hopefully the impetus for further study. As the events of the Tertiary have been reviewed in both botanical and geological literature they will not be reviewed here (Axelrod, 1950, 1958; Grant, 1959; Raven, 1962).

By the close of the Oligocene, a large xeric floristic element, the Madrotertiary flora, had developed between the tropical Neotertiary flora to the south and the temperate Arctotertiary flora to the north. As the primitive members of *Poliomintha* are today associated with the remnants of this flora, we can speculate that the Madrotertiary brought with it increased distribution and adaptive radiation in *Poliomintha*. Although it is possible that this period witnessed the origin of the group, it must be remembered that xeric sites, albeit limited in area, have been available to evolution since the Cretaceous (Axelrod, 1967). With the elevation of the western mountain axes in the Pliocene and early Pleistocene, increased aridity resulted in a dissection of the Madrotertiary flora into a number of isolated woodlands and widespread desert regions (Axelrod, 1950, 1958). Populations of *Poliomintha* perhaps at this time became contracted and fragmented with widespread extinction. However, with the development of true deserts, an evolutionary impetus was created to which *Poliomintha* responded, viz. *P. glabrescens* and *P. incana*. The role of the fluctuating environments of the Pleistocene is difficult to assess. Undoubtedly, there were distributional shifts and populational fragmentations.

SYSTEMATIC TREATMENT

POLIOMINTHA A. Gray, Proc. Am. Acad. 8:295. 1870.
HEDEOMA sect. POLIOMINTHA Briq. in Engler & Prantl, Nat. Pflanzenf. IV. 3a. 298, 1897.

Shrubs or semishrubs 1-3 m tall. Primary shoots numerous, narrowly

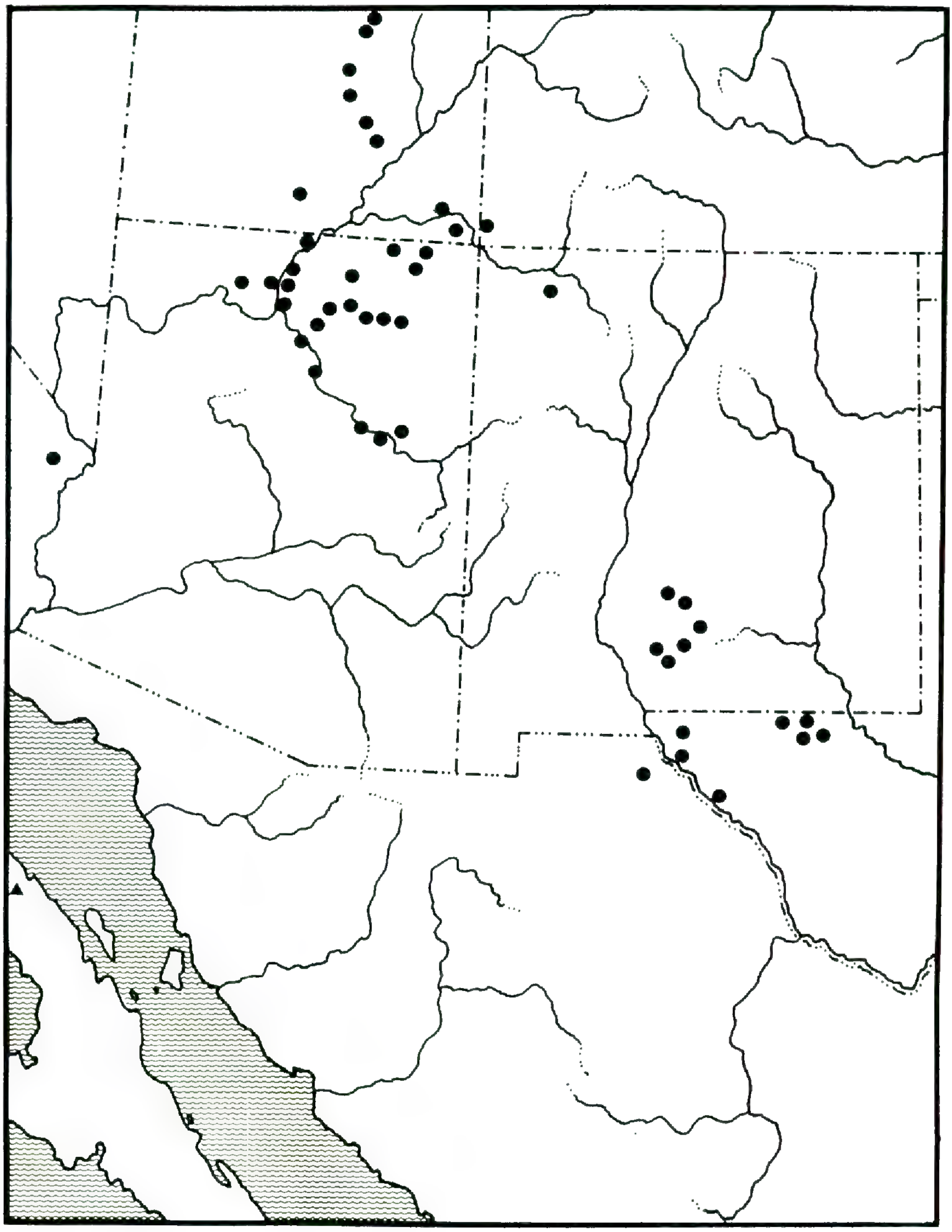

Fig. 2. Distribution of *Poliomintha conjunctrix* (triangles) and *P. incana* (circles).

or widely ascending, arising from a stout woody rootstock or caudex, puberulent, canescent, or tomentose with hairs spreading or antrorsely curling; branches slender and usually short, arising freely along the axes at wide or narrow angles. Leaves membranous, well spaced or crowded (internodes short), cernuous or spreading, linear, oblong, elliptical, ovate, or oval, 6-21 mm long, 1-6 mm wide, entire or serrulate, attenuated or

shortly petiolate, acute or obtuse; upper surfaces glabrate (*Saturejoides*) or tomentose (*Poliomintha*), lower surface strigillose or tomentose, hairs directed toward the apex; nervation inconspicuous, secondaries when prominent consisting of 2-3 alternating, straight pairs; both upper and lower surfaces uniformly glandular-punctate. Flowers solitary in the upper leaf axils or aggregated in 3—7-flowered cymes (cymules) in the upper 1/2-1/3 of the shoots; peduncles inconspicious or up to 3 mm long, pedicels 1-4 mm long, both peduncles and pedicels typically cinereous with retrorsely directed hairs; bracteoles (diminutive leaves subtending the pedicels) triangulate or subulate, shorter or longer than the pedicels. Calyx actinomorphic or nearly so, 4-12 mm long, 13—15-ribbed; the tube 3-9 mm long, cylindrical or pentagonal, the walls straight and not outwardly distended, cinereous or pilose, the antrorse or spreading hairs distributed uniformly or restricted to the ribs; calyx teeth 5, subequal or separable into an upper set of 3 and a lower of 2, variously pubescent on the inner face and convergent at some stage to close the calyx orifice; the upper teeth free or connate for 1/2 of their length, forming a small upper lip (*P. conjunctrix)*, triangulate, 1-3 mm long, 0.5—1 mm wide, equal to or shorter than the lower teeth; lower teeth never connate, narrowly or broadly triangulate, 1-3 mm long, 0.5—1 mm wide at the base; pubescence within the tube either cinereous and restricted to the teeth faces (*Saturejoides*) or pilose and in an irregular ring or annulus seated at the base of the teeth (*Poliomintha*). Corolla strongly zygomorphic, with a pronounced tube (within the calyx) and throat (above the calyx), the limbs forming a conspicuous subgaleate upper lip and a 3-lobed spreading lower lip, lavender, orange-red or red, 10-35 mm long, pubescent on the outer surface with spreading hairs, densely pubescent within at the juncture of the tube and throat to form an annulus 2-4 mm wide; the tube 4-12 mm long; the throat 4-16 mm long, tubular, arching upwardly, dilating dorsiventrally, occasionally laterally distended (*P. incana*); the upper lip ligulate, emarginate, and straight, 3-7 mm long, 2.5—5 mm wide at the base; the lower lip spreading, the lobes equal or subequal, the central lobe again bilobed and exserted beyond the laterals, 3.5—8 mm long, 3.5—10 mm wide. Fertile stamens 2, seated on the abaxial surface and arched upwardly under the upper lip; filaments glabrous, anther sacs widely divergent on well-developed connectives, usually well exserted at anthesis; sterile stamens 2, reduced to subulate, glabrous filaments 1-2 mm long, seated at about the mid-point of the tube. The style long, exserted, its apex arching downwardly and unequally bifid, the lower division twice the length of the upper. Nutlets oblong in outline, oval or ovate in cross section, light to dark brown, 1-2 mm long, 0.5—1 mm wide, the surface smooth but glandular at the apex, not becoming mucilaginous when moistened. Chromosome number, $2n = 36$.

Distribution (Fig. 1 & 2): Northern Mexico and southwestern United States. Center of distribution appears to be in the northern Sierra Madre

Mountains of Mexico.

Type species: Poliomintha incana (Torr.) Gray

KEY TO THE TAXA OF POLIOMINTHA

1. Leaves and stems canescent to glabrate; leaves oval or elliptical; calyx 5-9 mm long, cinereous, 13-ribbed; calyx annulus absent (Sect. *Saturejoides*).
   2. Flowers solitary in the axils; corolla orange-red, ca. 25 mm long.
      3. Leaves typically elliptical and well spaced; calyx teeth clearly converging at maturity; plants of Mexico. . . . . 1a. *P. longiflora* var *longiflora*
      3. Leaves oval or rhombic, very crowded; calyx teeth slightly converging at maturity; plants of Haiti. . 1b *P. longiflora* var *congesta*
   2. Flowers in axillary, 6-flowered cymes; corolla white-lavender, ca. 15 mm long. . . . . 2. *P. glabrescens*
1. Leaves and stems tomentose; leaves linear-oblong; calyx 3-4 mm long, pilose, often 15-ribbed, calyx annulus present (Sect. *Poliomintha*).
   4. Corolla tubular, orange-red, ca. 25 mm long; endemic to Baja California . . . . . 3. *P. conjunctrix*
   4. Corolla laterally inflated, lavender, up to 15 mm long; widespread throughout the southwest. . . . . 4. *P. incana*

POLIOMINTHA sect. **Saturejoides** Irving, sect nov. Frutices canescentes; folia ovalia vel elliptica; calyx 5.0-12.0 mm. longus, 13-costatus, annulo nullo. Type species *Poliomintha longiflora* Gray.

Canescent shrubs; leaves oval to elliptical; calyx 5-12 mm long, 13-ribbed, without an annulus.

1a. POLIOMINTHA LONGIFLORA Gray var. LONGIFLORA, Proc. Am. Acad. 8: 296. 1870. Holotype GH!: Mexico. COAHUILA. "Saltillo, mountains," 30 July 1848, *Gregg 313*. Isotype K!

Poliomintha bicolor Wats., Proc. Am. Acad. 25: 160. 1890. Holotype GH!: Mexico. NUEVO LEON. "Summit ledges, Sierra de la Silla," 5 June 1889, *Watson 2536*. Isotypes F!, NY!, PH!, UC!, US!

Hedeoma longiflorum (Gray) Briq. in Engler & Prantl, Nat. Pflanzenf. IV. 3a. 294, 1897. Based on *P. longiflora* Gray.

Hedeoma bicolor (Wats.) Briq., Ann. Conserv. Jard. Bot. Genève 2: 185. 1898. Based on *P. bicolor* Wats.

Poliomintha greggii Gray in Watson, Proc. Am. Acad. 25: 160. 1890 (nom. nud.).

Hedeoma greggii (Gray) Briq., Ann. Conserv. Jard. Bot. Genève 2: 185. 1898 (nom. nud.).

Robust shrubs or semi-shrubs 13-35 cm high. Shoots slender, ascending or somewhat decumbent, puberulent or glabrous below, pubescent or canescent above, hairs spreading, antrorsely curling, or appressed; branches slender,

brittle, and diverging at close angles. Leaves well spaced, spreading, or cernuous, oval to broadly or narrowly elliptical, 7-15 mm (11.3 mm) long, 2.5—6 mm (3.9 mm) wide, entire, attenuate and shortly petiolate, the petiole 1-2 mm long, apex obtuse, surfaces pubescent to tomentose below, glabrate above; nervation inconspicuous, the secondaries consisting of 2—3 alternate, straight pairs. Flowers solitary in the axils of the upper leaves, rarely in 2-flowered axillary cymes; peduncles prominent, 1.5—2 mm long; pedicels 1.5—4 mm long, cinereous with short antrorsely directed hairs; bracteoles lanceolate, exceeding the pedicels they subtend. Calyx 7-12 mm (9 mm) long, 13-ribbed; the tube 5.5—9 mm (6.9 mm) long, pentagonal, the sides straight and parallel below, becoming constricted above, evenly cinereous with appressed hairs; calyx teeth only scarcely differentiated into upper and lower sets, converging to close the orifice, densely and evenly pubescent within; the upper teeth very slightly connate (less than 1/2 their length), the lobes triangulate, 1.5—3 mm long, ca. 0.7 mm wide at the base; the lower teeth triangulate, 1.5—3 mm long, ca. 1 mm wide at the base; annulus absent, replaced by pubescence on the inner face of the teeth. Corolla orange-red, 27-35 mm (32 mm) long, pubescent within at the juncture of the tube and throat, the trichomes forming an annulus ca. 4 mm wide; the tube 7-12 mm long; the throat 15—16 mm long, expanded above, ca. 5 mm wide dorsiventrally; the upper lip broadly ligulate, emarginate, 5-7 mm long, 3.5—5 mm wide, straight (not upwardly reflexed), and flat (not concave); the lower lip 5-8 mm long, 6-10 mm wide, the lobes subequal with the central lobe slightly exserted beyond the laterals. Nutlets oblong in outline, ca. 2 mm long, 1 mm wide, the surface smooth but glandular distally. Chromosome number, $2n = 36$.

Distribution (Fig. 1). Open exposed sites in the foothills of the Sierra Madre Oriental and outlying ranges in Mexico; Monterrey, N.L., southwest to Catorce, S.L.P., 5,000-7,000 ft. June—September.

Despite the poor representation of *P. longiflora* in herbaria it is quite common throughout its range. On the somewhat inaccessible ridge tops and mesas where it is found it builds extensive populations. One of the most salient features of this species is its production of carvacol as the major constituent of its essential oil (Irving, unpublished). It is the same compound which gives the spice oregano (*Origanum* spp.) its distinctive odor and flavor. Because of this and the large size of its populations *P. longiflora* is collected in large quantities for sale locally or export to the United States as "Mexican oregano."

Representative specimens: MEXICO. COAHUILA: 6 mi SE of Saltillo, 21-23 Sep 1904, *Palmer 417* (GH, UC, US); 4 km E of Fraile, 11 Jul 1941, *Standford, Retherford & Northcraft 308* (DS, GH, UC); 3 mi SW of Saltillo, 3 Aug 1966, *Irving 703* (TEX); NUEVO LEON: Sierra de la Silla, 5 Jun 1889, *Pringle 2536* (F, GH, K, NY, PH, UC, US); SAN LUIS POTOSÍ: 12 km al W de Estacion Berrendo, municipio de Charcas, 11 Sep 1955, *Rzedowski 662* (GH, MICH, US); ca 30 mi W of Matehuala at Catorce, 1 Aug

1966, *Irving 695* (TEX); ZACATECAS: Aranzazu, 19 Jul 1934, *Pennell 17457* (MICH, PH); 2 mi above Maypil (W of conception del Oro), 2 Aug 1966, *Irving 698* (TEX).

1b. POLIOMINTHA LONGIFLORA Gray var. **congesta** Irving var. nov. Holotype MICH!: HAITI. Morne Vincent, M. des Commissaires, 14 Dec 1944, *Holdridge 2060*. Frutices glabrati; folia congesta, ovata, ovalia, vel rhombica, 6.0—9.5 (8.5) mm longa, 4.0—5.0 (4.7) mm lata, marginibus serrulata, basi decurrentia; calyx 9.0—10.0 mm longus, dentibus erectis; corolla rosea ca. 20.0 mm longa, annulata.

Robust shrubs up to 1 m in height. Shoots woody, ascending, with numerous short branches, glabrous and woody below, tomentose in the upper herbaceous stem regions. Leaves crowded, spreading, with margins becoming revolute on drying, ovate or rhombic, 6-9.5 mm (8.5 mm) long, 4-5 mm (4.7 mm) wide, serrulate, base attenuate, apex acute, petiole ca. 1 mm long, decurrent; both surfaces felty tomentose; nervation inconspicuous, the secondaries consisting of 2—3 subopposite, curved pairs. Flowers solitary in the uppermost leaf axils; peduncles ca. 0.7 mm long; pedicels ca. 3 mm long, cinereous; bracteoles linear-subulate, ca. 2.5 mm long. Calyx 9-10 mm long, 13-ribbed; the tube ca. 7 mm long, cylindrical but expanding upwardly, cinereous, the hairs antrorsely appressed, restricted to the nerves; calyx teeth slightly differentiated into upper and lower sets, pubescent on the inner face; the upper teeth connate for slightly less than 1/2 of their length, forming an upper lip, the lobes triangulate, ca. 1 mm long and 0.7 mm wide at the base, erect; lower teeth shorter than the upper, triangulate, ca. 1.5 mm long, ca. 0.5 mm wide at the base, erect or slightly converging with the upper; annulus absent. Corolla pink, ca. 20 mm long, densely pubescent in the tube, the trichomes forming an annulus ca. 7 mm wide; the tube ca. 9 mm long; the throat ca. 9 mm long, curved and expanded above, ca. 4 mm wide dorsiventrally; the upper lip broadly ligulate and cleft, ca. 2 mm long, 3 mm wide, straight and flat; the lower lip ca. 3 mm long, 5 mm wide. Nutlets not seen. Chromosome number, unknown.

Distribution (Fig. 2). Known only from the type locality. Details of its habitat are absent from the collection data.

2. POLIOMINTHA GLABRESCENS Gray, in Hemsl. Biol. Centr. Am. Bot. 2: 549. 1882. Holotype K!: MEXICO. COAHUILA. "Soledad, 25 mi SW of Monclova," Feb-Oct 1880, *Palmer 1056*. Isotypes F!, PH!, US!

Hedeoma glabrescens (Gray) Briq. in Engler & Prantl, Nat. Pflanzenf. IV. 3a. 294. 1897.

Semi-shrubs up to 50 cm tall. Shoots slender, sharply ascending, arising from a stout woody rootstock, puberulent throughout with minutely spreading hairs, occasionally densely so; branches brittle, slender, and diverging at close angles. Leaves cernuous, oblong to elliptical, 7-16 (12 mm) long, 3-4 mm (3.6 mm) wide, entire, subsessile, apex acute or obtuse; strigillose below, glabrate above; nervation inconspicuous, the secondaries consisting of 2—3 indistinct, alternate pairs. Flowers in 5—7-flowered axillary

cymules along the upper 1/2 of the shoots; peduncles conspicuous, ca. 1 mm long; pedicels ca. 1 mm long, canescent; bracteoles linear-lanceolate, longer than the pedicels they subtend. Calyx ca. 5 mm long, 13-ribbed; the tube 3.8 mm long, tubular or slightly pentagonal, evenly canescent with short appressed hairs; the calyx teeth scarcely differentiated into upper and lower sets, densely tomentose on their inner borders and apex, triangulate; the upper ca. 1.2 mm long, ca. 0.5 mm wide at the base; the lower ca. 1.2 mm long, and 0.7 mm wide at the base; all 5 teeth tightly convergent to close the calyx orifice; annulus absent. Corolla lavender, ca. 13 mm long, with a well-defined annulus at the juncture of the tube and throat, ca. 1.5 mm wide; the tube ca. 5 mm long; the throat ca. 5 mm long, dilated above, ca. 4 mm wide dorsiventrally; the upper lip ligulate, emarginate, ca. 4 mm long, ca. 3 mm wide, straight and somewhat concave; the lower lip ca. 4 mm long, ca. 5 mm wide, the lobes equal or subequal with the central lobe slightly exserted beyond the laterals. Nutlets oblong, ca. 1.5 mm long, ca. 0.7 mm wide, the surface smooth, glandular at the apex. Chromosome number, unknown.

Distribution (Fig. 1). Dry calcareous hills in the Chihuahuan Desert; Texas to Coahuila, Mexico. 4,000—6,000 ft. August—September.

Representative specimens: MEXICO. COAHUILA: Castanos, Puerta de San Lazaro, Sierra de San Lazaro, 30 Aug 1939, *Muller 3038* (GH, MICH, UC); Cuatro Cienegas, Sierra de la Madera, Canon del Aqua, 10 Sep 1939, *Muller 3255* (GH, MICH, UC); UNITED STATES. TEXAS: BREWSTER CO., Mc-Rae Canyon on Cox Ranch, 31 Jul 1953, *Warnock 11397* (LL); PRESIDIO CO., Solitario Peak area, 30 Jul 1957, *Warnock 15710* (NY, TEX).

POLIOMINTHA sect. POLIOMINTHA. Type species *Poliomintha incana* (Torr.) Gray. Tomentose shrubs; leaves linear-oblong; calyx 4.0—7.0 mm long, cinereous or villous, 13—15-ribbed, annulate.

3. POLIOMINTHA CONJUNCTRIX Epling & Wiggins, Contrib. Dudley Herb. 3:85. 1940. Holotype DS!: MEXICO. BAJA CALIFORNIA. "5 mi SE of Rancho San Antonio," Buenos Aires Plains, 20 Jun 1937, *George Lindsay, s.n.* (accession no. 259214). Isotype F!

Tall slender shrubs over 1 m in height. Shoots widely ascending, arising from a woody caudex, tomentose with a felty tomentum of retrorsely appressed hairs; branches short, brittle, diverging at wide angles. Leaves cinereous, cernuous, linear—oblong, 7-17 mm (13 mm) long, 2.5—3.5 mm (2.6 mm) wide, entire, attenuated and sessile, apex narrowly or broadly obtuse; surfaces tomentose, the lower densely so. Flowers in 3-flowered axillary cymules borne in the upper 1/3 of the shoots; peduncles 2-3 mm long; pedicels 1.5—2 mm long, tomentose with antrorsely appressed hairs; bracteoles subulate, shorter than the pedicels they subtend. Calyx 6-7 mm (6.5 mm) long, 13-ribbed; the tube 5.5—6.5 mm (6 mm) long, symmetrical and tubular, cinereous with short antrorsely curling hairs restricted to the nerves; calyx teeth subequal, slightly differentiated into upper and lower

sets, erect or slightly converging at maturity; the lower set slightly shorter than the upper, connate for ca. 1/2 its length, the lobes triangulate, 0.5 mm long and ca. 0.5 mm wide at the base; the upper teeth narrowly triangulate, ca. 1 mm long, ca. 0.7 mm wide at the base; annulus an irregular dense ring of long hairs (pilose) seated at the base of the teeth and extending upward onto the inner tooth faces, slightly exserted. Corolla orange-red, 20-21 mm long, densely pubescent at the juncture of the tube and throat, the trichomes forming an annulus ca. 3.5 mm wide; the tube 6-7 mm long; the throat ca. 11 mm long, expanded above, ca. 4 mm wide dorsiventrally; the upper lip ligulate, emarginate, ca. 7 mm long and 3 mm wide; the lower lip ca. 5 mm long, ca. 5 mm wide, the lobes subequal. Nutlets tan, oblong in outline, ca. 2 mm long, ca. 1 mm wide, the surface smooth or weakly areolate, glandular at the apex. Chromosome number, unknown.

Distribution (Fig. 2). Known only from the type locality.

4. POLIOMINTHA INCANA (Torr.) Gray, Proc. Am. Acad. 8: 296. 1870.
Holotype NY!: TEXAS. EL PASO CO., "near El Paso," *Parry, Wright, Bigelow* (*Wright 1523*). Isotypes, GH!, K!, PH!, US!
Hedeoma incanum Torr., U.S. Mex. Bound. Surv. 130. 1859.

Robust canescent shrubs to 3 m high. Shoots slender, ascending, bearing gray-fissured bark below, tomentose with short, retrorsely appressed hairs above; branches slender and arising at close angles. Leaves gray-green, spreading or cernuous, linear-oblong or occasionally obovate below, 11-21 mm (15 mm) long, 1.3—3 mm (2.1 mm) wide, entire, attenuated and sessile, apex acute or obtuse; surfaces equally tomentose or tomentulose; nervation indistinct. Flowers typically in 3-flowered axillary cymules borne in the upper 1/2 of the shoots; peduncles ca. 1 mm long; pedicels ca. 1.1 mm long, tomentose; bracteoles linear, longer than the pedicels they subtend. Calyx 4-5 mm long, 13—15-ribbed; the tube 3-4 mm long, cylindrical, the sides parallel, moderately to densely pilose with hairs up to 2 mm long, strigose beneath the pilose coat; calyx teeth subequal, only scarcely differentiated into upper and lower sets, lower slightly longer than upper, narrowly triangulate, 1-2 mm long, ca. 1 mm wide at the base; teeth converging to close the calyx orifice; annulus an unequal dense ring of exserted long hairs (pilose) situated at the base of the teeth. Corolla lavender, 10-14 mm long, pubescent at the base of the tube and throat, the trichomes forming an annulus; the tube 8-9 mm long; the throat both laterally and dorsiventrally inflated (3-5 mm wide laterally and dorsiventrally); the upper lip ligulate, emarginate, 3.5—4 mm long, ca. 2.5 mm wide, straight and slightly concave; the lower lip ca. 3.5 mm long, 3.5—4 mm wide, the lobes unequal, the central lobe bilobed and exserted beyond the laterals. Nutlets oblong, ca. 2 mm long, ca. 1 mm wide, the surface smooth and glandular. Chromosome number, unknown.

Distribution (Fig. 2). Sand hills frequently of gypsum origin; Mexico,

Texas, New Mexico, Arizona, Utah, Colorado, and California. 2,000—4,000 ft. April—October.

Poliomintha incana is the most widespread member of the genus, although disjunctively so, and forms extensive populations where it occurs. It is apparently well adapted to the dune-sand habitat and is able to withstand repeated burial.

Representative specimens: MEXICO. CHIHUAHUA: near El Paso del Norte, 9 Apr 1885, *Pringle 275* (F, GH, PH, POM, US); Samalayuca, 28 Jan 1903, *Coville 1700* (US); 5 mi S of Samalayuca, 19 Apr 1960, *Cruchfield & Johnston 5265* (MICH, TEX); UNITED STATES. ARIZONA: APACHE CO., Holbrook, 20 Aug 1883, *Rusby 784* (MICH, PH, UC, US); COCONINO CO., 10 mi W of Navajo Bridge, 24 May 1939, *Barkley & Reed 4370* (DS, PH, POM, UC); NAVAJO CO., Monument Valley, 14 Sep 1938, *Eastwood & Howell 6656* (CAS, US); CALIFORNIA: SAN BERNARDINO CO., Cushenbury Springs, 12 Jul 1938, *Jaeger s.n.* (POM); COLORADO: MONTEZUMA CO., E of Aneth, Utah, 19 Jun 1968, *H. D. Harrington 10107* (CS); NEW MEXICO: DONA ANA CO., White Sands, 19 Jun 1899, *Wooton s.n.* (DS, MICH, NMC, POM, TEX, UC, US); OTERO CO., 13 mi W of Tularosa, 5 Jun 1938, *Cutler 2016* (CAS, GH, UC); SAN JUAN CO., S of Bloomfield, 5 Jul 1929, *Mathias 615* (GH, POM); TEXAS: CULBERSON CO., 29 mi W of Orla, 11 Jul 1965, *Irving 613* (MONTU, TEX); EL PASO CO., 2 mi NE of Fabens, 5 Jul 1958, *Correll & Johnston 19276* (LL); HUDSPETH CO., 3 mi E of McNary, 18 Apr 1930, *Cory 3445* (POM); UTAH: EMERY CO., 20 mi SW of Greenriver, 3 Jun 1953, *McVaugh 14421* (CAS, MICH, TEX); GARFIELD CO., 16 mi N of Hite & 35 mi S of Hanksville, 17 May 1961, *Cronquist 9055* (DS, MICH, TEX, UC); GRAND CO., ca 1 mi N of Moab, 20 May 1957, *Vickery, Jr. 801* (DS, GH, UC); SAN JUAN CO., 5 mi N of Mexican Hat, 24 Jul 1939, *Cutler 2779* (DS, GH); WAYNE CO., 15 mi S of Hanksville, 16 May 1950, *Harrison 11532* (UC).

EXCLUDED NAMES

Poliomintha marifolia (Briq.) Gray, Proc. Am. Acad. 8: 365. 1872. = *Hesperozygis marifolia* (Briq.) Epling in Rep. Spec. Nov. Beiheft 115: 13. 1939.

Poliomintha mollis (Torr.) Gray, Proc. Am. Acad. 8: 365. 1872. = *Hedeoma molle* Torr. in Bot. U.S. & Mex. Boundary Surv. 2(1): 129. 1859.

ACKNOWLEDGEMENTS

Acknowledgement is made to all persons responsible for the loan of specimens. Abbreviations of herbaria from which specimens were borrowed are those standardized by Lanjouw & Stafleu (1964). Thanks are also given to Drs. D. Bilderback and C. Miller for their help with the manuscript.

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TWO NEW SPECIES OF ISOCOMA (COMPOSITAE-ASTEREAE) FROM NORTH CENTRAL MEXICO

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ISOCOMA **halophytica** Turner sp. nov.

Frutex ad 1 m altus; caudex distincte lignosus fide collectorum; caules fide collectorum decumbentes fragiles dense pubentes pilis brevibus ubi juvenes demum glabrescentes. Folia integra uniformiter lineario-oblanceolata dense pubentia pilis brevibus plerumque 1.5—2.5 cm longa 1.5—2.0 (—3.0) mm lata apice mucronibus albis.

Caules secundarii 10—25 cm longi 5—8-capitulati capitulis dense confertis 15—18-floris. Involucra subturbinata 4—5 mm alta 4—5 mm lata 2—3-seriata. Exteriora phyllaria dense pubentia. Interiora phyllaria scariosa apicibus latis fuscatis ciliatis. Receptaculum planum alveolatum radiati flores nulli. Disci flores flavi corollis 7—8 mm longis tubulis 4—5 mm longis faucibus distincte obliquiis 2.0—2.5 mm longis lobulis acutis 1.0—1.5 mm longis. Styli rami ca 1 mm longi appendiculibus dense pubentibus acutis. Achenia ca 2 mm longa dense pubentia pilis antrorsis plerumque adpressis. Pappus 50—60-setosus setis 3—5 mm longis.

Shrub up to 3 ft tall, the stems (according to label data) decumbent, arising from a decidedly woody rootstock. Stems brittle, at first densely short pubescent, becoming glabrate with age. Leaves entire, uniformly linear-oblanceolate, densely short pubescent, mostly 1.5—2.5 cm long, 1.5—2.0(3.0) mm wide, terminated by a small, white mucro. Heads 5—8, densely clustered at the apexes of secondary stems, the latter 10—25 cm long. Involucres subturbinate, 4—5 mm high, 4—5 mm broad. Bracts imbricated in about 2—3 lengths, the outer row densely pubescent, the inner scarious with broad, darkened, ciliate apices. Receptacle flat, alveolate. Ray flowers absent. Disc florets yellow, 15—18; corollas 7—8 mm long, tube 4—5 mm long, throat decidedly oblique, 2.0—2.5 mm long, the lobes 1.0—1.5 mm long, acute. Style branches about 1 mm long, the appendage densely pubescent, acute. Achenes ca 2 mm long, densely pubescent with mostly appressed, ascending hairs. Pappus of ca 50—60 bristles, 3—5 mm long.

MEXICO. Coahuila: Along road from San Vicente SW (about 7 mi) to southern end of Laguna de Jaco. "Rocky saline soil at south end of lake, stems decumbent, up to 3 ft tall." 9 Sep 1940. *I. M. Johnston* & *C. H. Muller 1090*. (Holotype, MICH).

Isocoma halophytica has non-fasciculate, entire leaves, deeply cleft corollas and, except for the former, would most readily key to *I. pluriflora* (= *T. wrightii*) in Hall's (1928) treatment of the genus. However, it is

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readily distinguished from that species by its densely pubescent, gray foliage, apparently sprawling habit, and short, broad involucres. The taxon is known only from the locality concerned where, I suspect, it occurs in gypseous-saline soils.

ISOCOMA **gypsophilia** Turner sp. nov.

Herbae perennes 5—10 cm altae caulibus foliisque recumbentibus saepe eleganter tegetiformes 10—40 cm diametro laxae vel crebrae succulentae. Caules sparse vel dense pubentes pilis ascendentibus crispatis albis. Folia principalia 0.5—1.0 cm longa spathulata vel oblanceolata conspicuo glandulo-punctata sparse pubentia pilis ascendentibus crispatis dense conferta imbricata caulem occultantia plerumque 3—4-dentata apicem versus dentibus distincte albomucronatis. Rami secundarii apice pedunculiformes uniflori rare biflori 2—10 mm longi. Capitula 30—40-flora. Involucra late turbinata vel hemisphaerica 7—9 mm alta 6—9 mm lata 4—5-seriata. Phyllaria ordinate imbricata viridia conspicuo glandulo-punctata ciliata apicem versus. Receptaculum planum conspicuo setaceo-alveolatum. Radiati flores nulli. Disci flores flavi corollis ca 5—6 mm longis tubulis 3—4 mm longis faucibus 2 mm longis lobulis ca 0.5 mm longis. Styli rami ca 1 mm longi appendiculibus ovatis dense papillatis. Achenia ca 2 mm longa dense pubentia pilis adpressis argenteis. Pappus 30—40-setosus setis 3—5 mm longis. Chromosomatum numerus $n = 6$.

Perennial herb 5—10 cm tall, the stems and foliage more or less recumbent, often forming an attractive, loose to compact, succulent, dark green mat, 10 to 40 cm across. Stems sparsely to densely pubescent with crisp, white hairs; principal leaves, 0.5—1.0 cm long, spatulate to oblanceolate, densely crowded and overlapping so as to obscure the stem, mostly 3—4 dentate near the apex, each of the denticulations terminated by a distinct, white mucro, the blades conspicuously glandular-punctate and sparsely covered with a loose, crispy, crinkled pubescence. Heads single (or rarely double) on peduncles 2—10 mm long at the apices of secondary branches. Involucres broadly turbinate to hemispheric, 7—9 mm high, 6—9 mm broad. Bracts regularly imbricated in about 4-5 lengths, green and conspicuously glandular-punctate above, the margins ciliate, especially near the apices. Receptacle flat, conspicuously bristly alveolate. Ray flowers absent. Disc florets yellow, 30—40; corollas ca 5—6 mm long, tube 3—4 mm long, throat 2 mm long, the lobes ca 0.5 mm long; style branches about 1 mm long, the ovate appendages densely papillate. Achenes ca 2 mm long, densely pubescent with silvery, appressed hairs; pappus of 30 to 40 setae, 3—5 mm long. Chromosome number, $n = 6$.

MEXICO. Nuevo Leon: 15 mi S of San Roberto Junction. Growing on white, gypseous soils on what appears to be saline flats along the roadside. 26 Sep 1970 *B. L. Turner 6213*. (Holotype, TEX; isotypes to be distributed).

The taxon is apparently most closely related to *Isocoma veneta* (HBK) Greene, a widespread species of central and northern Mexico where it occurs in mostly rocky limestone soils, or less frequently in mixed gypseous,

alluvial soils, as noted below. On the former soils it apparently assumes a more robust form; the latter sites characteristically producing a low, suffrutescent sub-shrub about 30—40 cm tall. Both of these forms grow in the vicinity of the type locality and both have diploid counts of $n = 6$ (*Turner & Crutchfield 6313,* robust form; *Turner & Crutchfield 6289,* small form) as does *I. gypsophila.* The latter, however, grows only in gypsum, forming open stands with such endemic gypsophilous species as *Frankenia gypsophila, Sartwellia mexicana, Atriplex reptans* and a remarkable, as yet unpublished, new genus of the Compositae, tribe Tagetinae (Turner, in press).

Isocoma gypsophila is readily recognized from all other species of the genus by its habit; small, overlapping leaves; predominantly single-headed flowering stems; and broad involucres possessing conspicuously punctate involucral bracts. The species was found growing with or near *I. veneta* (*Turner & Crutchfield 6303*) which, while relatively small at this locality, has a decidedly woody, 3—5 headed, glutinous stem and subturbinate involucres, the latter composed of only faintly punctate, eciliate involucral bracts. Intermediates between the two taxa were not seen in the field, in spite of a search for these in a second visit to the site. (In my initial visit I was unaware that the material here described as *I. gypsophila* might even be a species of *Isocoma*!)

The holotype consists of 5 plants. On an additional sheet I have included a plant of *I. veneta* (found along the roadside at the type locality) along with isotypic material of *I. gypsophilia.* I follow Shinners (1950), M. C. Johnston (1967) and perhaps others in recognizing the natural group *Isocoma* as a genus, believing Hall's treatment of the taxon as part of *Haplopappus* to be highly artificial, in spite of his claims to the contrary.

I am grateful to Dr. M. C. Johnston for the Latin descriptions. Field work was supported, in part, by NSF grant 5548X.

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FIELD OBSERVATIONS OF CUTHBERTIA (COMMELINACEAE) WITH DESCRIPTION OF A NEW FORM

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The genus *Cuthbertia* Small includes three closely related species that are endemic to the South Atlantic Coastal Plain. The combination *Cuthbertia rosea* (Vent.) Small (1903) superseded *Tradescantia rosea* Vent. (Jard. Cels. pl. 24, 1800). In addition, Small described *C. graminea* and *C. ornata* as new species (1933). Later Anderson and Woodson (1935) reduced *Cuthbertia* to synonomy under *Tradescantia* and made Small's three species into varieties, thus *Tradescantia rosea* var. *rosea*, *T. rosea* var. *graminea* (Small) Anders. & Woods., and *T. rosea* var. *ornata* Anders. & Woods. The authors apparently did not recognize the morphological distinctions of the involucral bracts that Small used to seperate the two genera.

Woodson, after a comprehensive study of American and tropical genera of Commelinaceae, chose to emphasize the structure of the inflorescence in the delimitation of genera. Reevaluation of his earlier revision led him to transfer *Tradescantia rosea* var. *rosea* to *Tripogandra rosea* (Vent.) Woods. However, he did not make any transfers involving *T. rosea* var. *graminea* or *T. rosea* var. *ornata* because he was not certain of their proper taxonomic status. Woodson stated that none could be made until "extensive field study" had been completed.

After several years of observation of the plants, both in the field and in cultivation in the botanical garden, I am convinced that Dr. Small's delimitation of *Cuthbertia* is valid. Other workers (Giles, 1942, 1943; Tomlinson, 1966) concur with this position, using other lines of evidence to reach the same conclusion. The following taxonomic diagnosis is offered based on my field and garden observations.

CUTHBERTIA

Perennial herbs in small or large tufts. Stems and leaves glossy green or yellowish green, nodose, never hirsute, stems erect to spreading. Leaves fleshy, semiterete, or flat, folded when young, with a closed sheathing base; stomata abaxial; sheaths red-striate, or sometimes whitish-striate, with oblique orifice. Roots fibrous, lanate or glabrate, clustered or spreading and fistulose (even at extremities).

Flowers ephemeral, bisexual, trimerous, radially symmetrical; sepals green or petaloid; petals free, roseate, or rarely white, crenulate on margins; stamens six in two alternating cycles of three's, all fertile and morphologically similar; anther connective trapezoidal; pollen yellow; stamen

[1] Contribution 61, Botanical Laboratories of University of South Florida.

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hairs roseate, rarely white, moniliform, in groups on the lower part of the filament, the upper part hairless; ovary superior, 3-locular, typically 6-ovulate; pistil white; style declinate, tubular, dilating to tubular stigma. Capsule loculicidal, valves coriaceous, persistent; seeds hemispherical, ribbed-reticulate, hilum punctiform. (*Tradescantia* L. of authors; *Tripogandra* Raf. of authors.)

KEY TO SPECIES

1. Leaves loosely spreading, blades linear or linear-lanceolate, flat, as wide or wider than the sheaths; roots slender, yellow; capsules obovoid-trigonal. . . . . 1. *C. rosea*
1. Leaves erect or ascending; blades linear, narrower than the sheaths; roots dilated at bases; capsules globose—oblong-trigonal.
   2. Plants in small tufts with a few erect stems; roots copiously lanate, clustered. . . . . 2. *C. ornata*
   2. Plants cespitose, with numerous branching, close-set stems; roots moderately lanate, glabrate. . . . . 3. *C. graminea*

1. CUTHBERTIA ROSEA (Vent.) Small. in Fl SE. U.S. 237. 1903.

Tradescantia rosea Vent. Jard. Cels. pl. 24, 1800.

Tripogandra rosea (Vent.) Woods. Ann. Mo. Bot. Gard. 29: 141-154. 1942.

Plants 2—5.5 dm tall; leaf blades 0.8—2.5 dm long, 4—15 mm wide, puberulent or glabrous; cymes 10—15-flowered; involucral bractlet 3—5 mm long, simple or cleft, rarely acuminate to 14 mm long. Sepals 3—5 mm long, suffused with rose; petals ovate, 8—12 mm long, shallowly crenulate, bright rose; capsules 3—4 mm long; seeds silvery gray, ribbed-reticulate, 2 mm wide. Sandy banks, hammocks; Southampton Co., Virginia to vicinity of Jacksonville, Florida.

2. CUTHBERTIA ORNATA Small, Man. SE. Fl. 259. 1933.

Tradescantia rosea Vent. var. *ornata* (Small) Anders. & Woods. Contrib. Arn. Arb. 9: 111-116. 1935.

Small in describing *C. ornata* did not designate a type specimen. The LECTOTYPE selected is *Small and Winkler 9054*, sandhills of Avon Park to Sebring, De Soto County, 1 May 1919 (NY). A later civil division of De Soto County placed the type locality in Highlands County.

Plants 2.5—4.5 dm tall, yellowish green, essentially glabrous, branches few, internodes 2—4; leaf blades 1.7—2.5 dm long; sheaths red-striate, 0.3—1.7 mm long. Involucral bract 1—3 mm long; bracteoles 2 mm long, base greenish, whitish on margins. Cymes 3—15-flowered, pedicels 10—14 mm long; flowers opening two or three at a time; sepals 4—5 mm long, petaloid, apex slightly incurved; petals 10—15 mm long, prominently crenulate; stamen hairs often purplish; filament white, sometimes suffused with pink. Mature capsules 3—5 mm long; seeds 2 mm wide, typically compressed, silvery, ribbed. Distributed only in Florida; oak scrub and sandhills.

3. CUTHBERTIA GRAMINEA Small, Man. SE. Fl. 259. 1933.
Tradescantia rosea Vent. var. *graminea* (Small) Anders. & Woods. Contrib. Arn, Arb. 9: 111-116. 1935.

HOLOTYPE: *J. K. Small,* June 27-July 1, 1895, about Augusta, Richmond Co., Georgia (NY).

Plants 0.4—3.8 dm tall, glabrous with 6 or fewer nodes. Leaf blades 0.4—2 dm long, 1—5 mm wide; sheaths purple-striate, pilose about orifice, puberulent on surface. Roots from rhizomatous base crowns or in congested tufts from the lower nodes. Involucral bracts 3 mm or rarely 14 mm long, cleft or obscurely lobed. Flowers 3—13 or more; pedicels 8—12 mm long; sepals green, suffused with rose; petals 8—10 mm long, bright rose. Mature capsules 3.5 mm long; seeds 1.5—1.8 mm wide, ribbed-reticulate, typically silvery. $2n = 12, 24, 36$. Sandy woods; Coastal Plain, adjacent to the Fall Line, and in the interior formations throughout the range of the genus.

CUTHBERTIA GRAMINEA Small f. **leucantha** Lakela, f. nov. HOLOTYPE: *Lakela 32048* (USF). A typo different cum petalis, staminibus et pistillo albidis.

Grown from offshoots of plant collected 1 April 1969, sandhill, vicinity of University of South Florida campus, 18 May 1970, Plates 1, 2, 3. Differs principally from forma *graminea* in absence of anthocyanin pigments, hence bracteoles, sepals, and leaves margined with white; stem bases, nodes, sheath striations suffused with white; petals, stamen filaments, and hairs white; anthers and pollen yellow; pistil wholly white with lustrous stigma. $2n = 12$.

After several years of field acquaintance with pink-flowered *Cuthbertia,* the appearance of a color variant was more than a passing surprise. A luxuriant plant with many flowering stems and white budding cymes was discovered in an opening of a sandhill vegetation April 1, 1969. To facilitate continued observations, two stems were detached and transferred to the University Botanical Garden. Later, upon returning to the site for flowering and fruiting specimens, the plant was not there and others could not be found. Perpetuation of the novelty depended on the two plants in cultivation. The attractive white flowers opened at dawn and closed in the early afternoon. After ripening of the pollen, petals with stamens rumpled over the ovary and the style remained exserted beyond the closed sepals. Fruit did not form, however, and the flowers one after another fell with withered pedicels.

The flowerless rachis with persistent bracteoles did not wither. In due time, tips of green leaves appeared in axils of proximal bracteoles, and below, tips of rootlets were elongating. One of the plants on September 11, 1969, had an offshoot of five leaves 3—8 cm long. The stem was cut above the roots and pressed as a herbarium specimen. The other plant was more prolific by producing two offshoots of similar size. The reclining stem tip was secured in soil until the plants were independent. During the cooler months, the plants were placed in the lath house where they freely

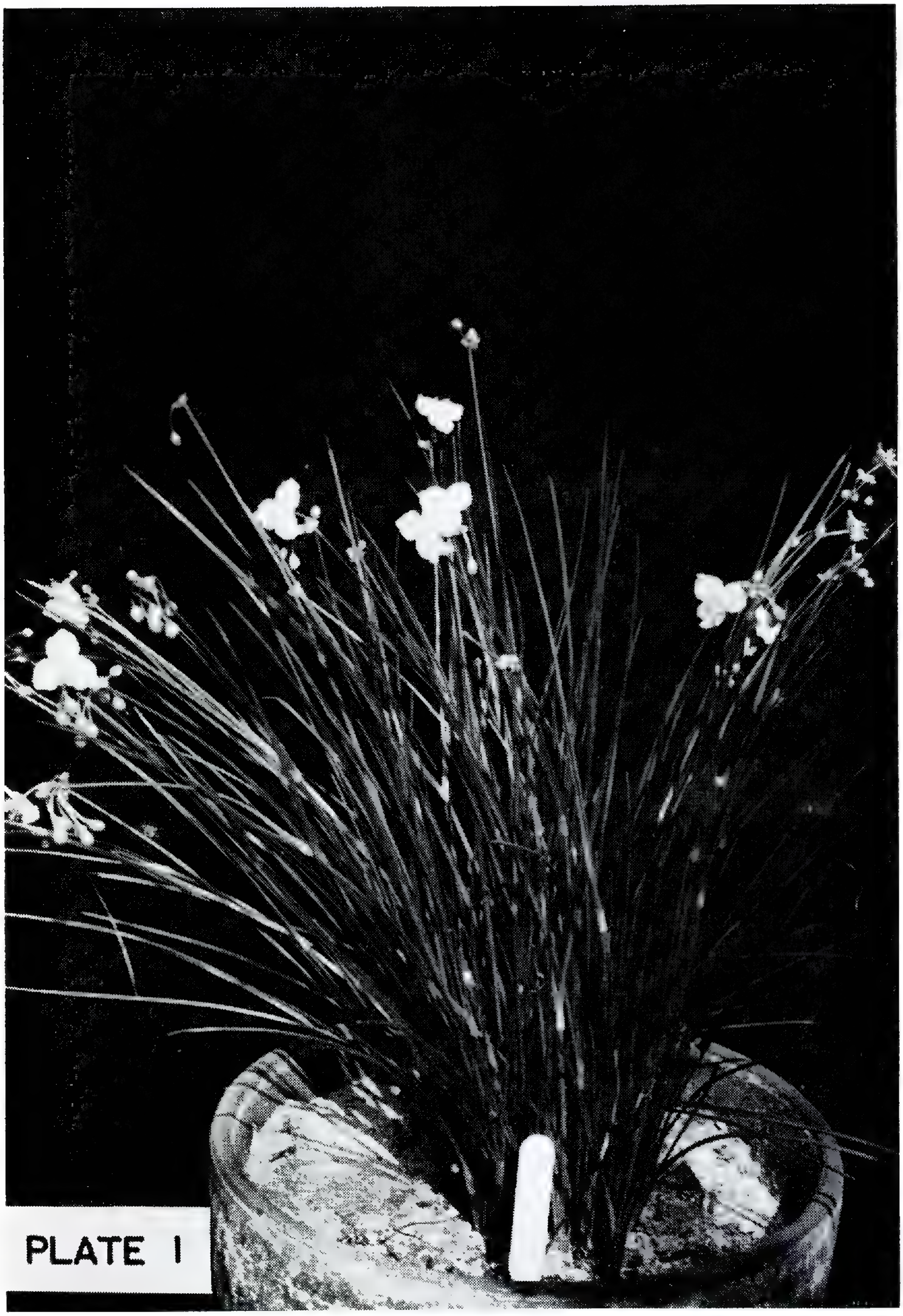

Plate 1. *Cuthbertia graminea* f. *leucantha*: plant grown from offshoots for type specimens, *Lakela 32048*.

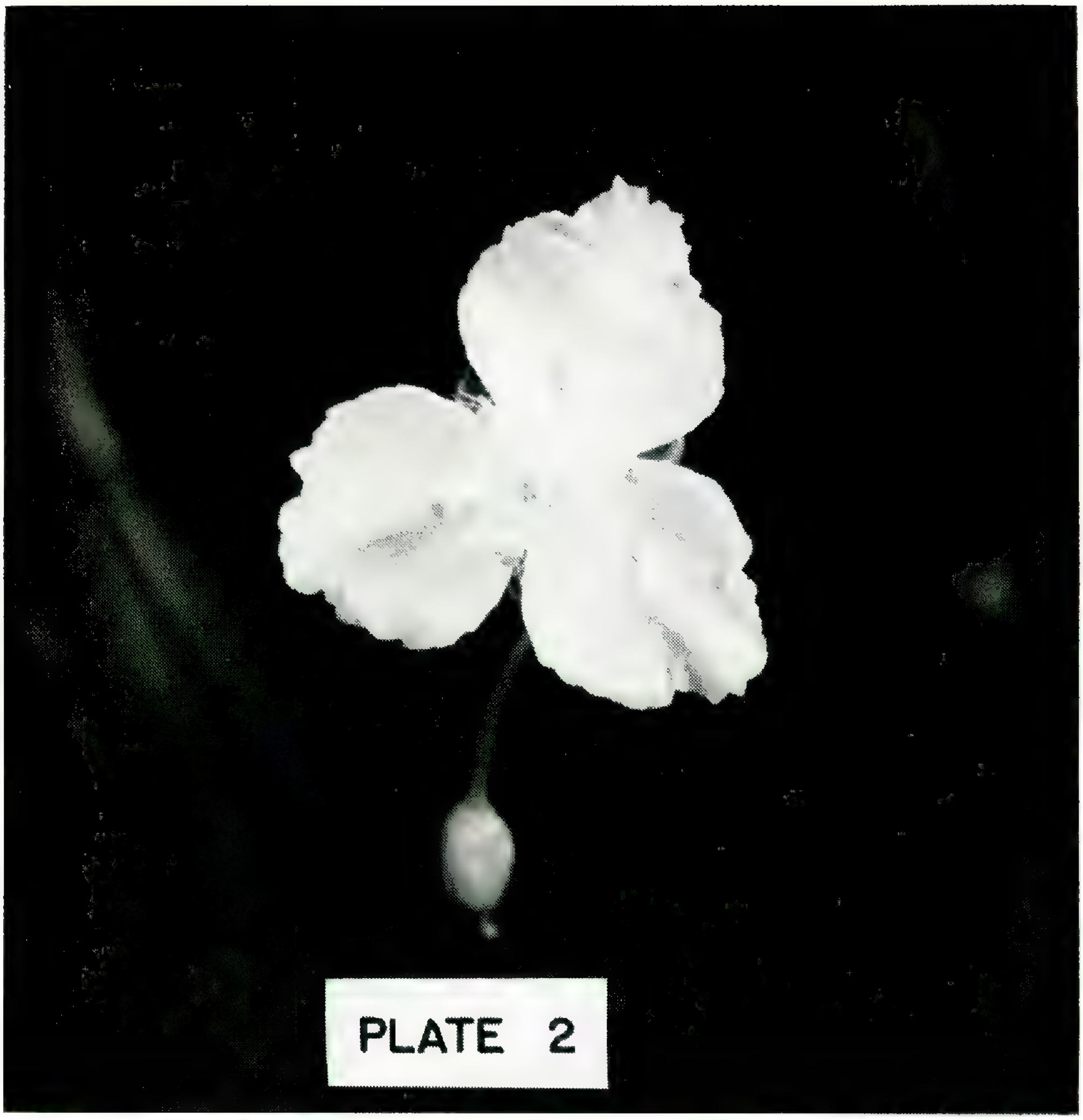

Plate 2. *Cuthbertia graminea* f. *leucantha*: flower with dehisced anthers, the other in post anthesis with mature stigma.

flowered and fruited through the spring of 1970. The plants, developing from the two offshoots since September 1969 comprise twenty flowering stems.

Seeking parallelism of rachial propagation in nature, at least one prone stem of *C. ornata* was found with a rooting propagulum in sand of the topo-site of forma *leucantha*. This is an undeveloped wooded area, west side North 30th Street, North Tampa. Although spoiled and destined for destruction by urban development its vegetation still features many native species typical to *Pinus palustris-Quercus laevis* association. In the undergrowth on mats of pine needles and among grasses, thrive fourteen Fabaceous genera, and various Florida endemics such as *Cacalia floridana, Baptisia Lecontei, Phoebanthus grandiflora, Cuthbertia ornata, Cuthbertia graminea* forma *graminea* and forma *leucantha*. The white-flowered variant reap-

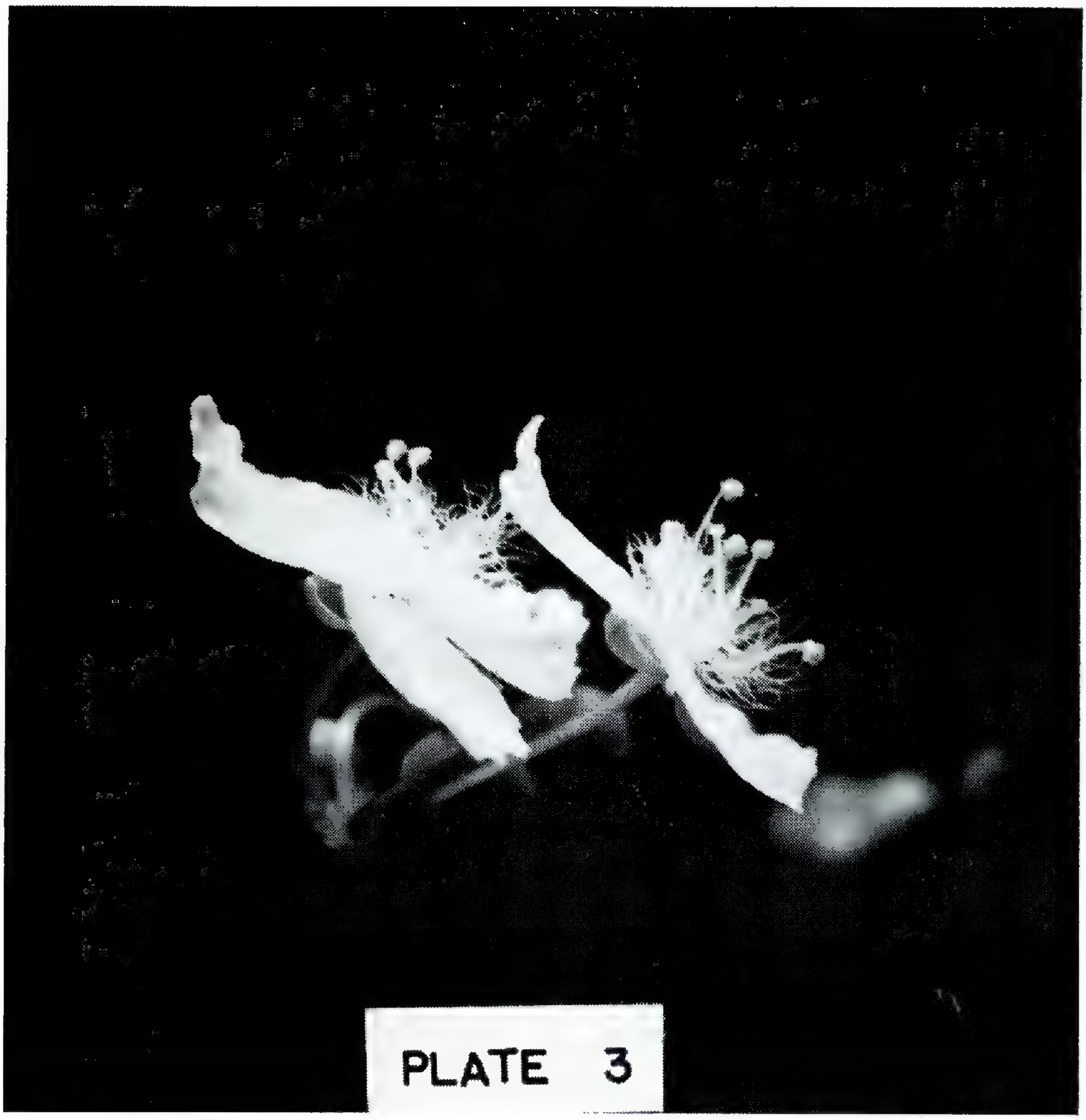

Plate 3. *Cuthbertia graminea* f. *leucantha:* declining style with unripe stigma among mature stamens.

peared in 1971. At present its known distribution is extended to Pinellas County.

The author is indebted to the late Dr. Lloyd H. Shinners for his advice in literature, for the xeroxed references received from the SMU Science Library; to the University of Michigan for the type plate of *Cuthbertia rosea*; to Dr. Harold Moore, for sharing his concept of the generic status of *Cuthbertia*; to Dr. Wilbur Duncan for sending living plants of *C. rosea*; to Mrs. Martha Meagher for the chromosome number; to Curators of the New York Botanical Garden and the University of North Carolina for loans of specimens; and to Dr. Long for consultation, editing, and for the Latin description.

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OBSERVATIONS ON SOME UPPER AMAZONIAN FORMICARIAL MELASTOMATACEAE

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The observations reported here were made in the area around Leticia, Amazonas, Colombia during July and August 1968, and have subsequently been extended by further study in the herbarium. Nevertheless, apart from the section on taxonomic notes, the main emphasis is on the field observations, and the extent to which they support (or not) some current ideas related to formicaria and to speciation in the tropical rain forest.

The author citations for all names used in the first two sections of the paper (unless given) are provided in the section on taxonomic notes. Specimens collected from the various populations studied in the field are listed at the end of the paper.

FORMICARIA

A large proportion of upper Amazonian melastomes have formicaria. Among these are *Maieta guianensis* var. *guianensis, M. guianensis* var. *leticiana, M. poeppigii, Ossaea bullifera, Tococa juruensis, T. ulei* and *T.* aff. *stephanotricha,* which were studied in the field. Quantitative observations of the disposition of formicaria on a number of plants were made for *M. guianensis* var. *leticiana, M. poeppigii, T. ulei,* and *T.* aff. *stephanotricha,* while qualitative observations were made for the other three taxa.

In *Maieta guianensis* (Fig. 2A,B) and *M. poeppigii* (Fig. 2C), the leaves of a pair are usually markedly unequal; the larger leaf has a well-developed formicarium, the smaller leaf not. The general habit of *Maieta* is illustrated in Fig. 1, showing the relative positions of the larger and smaller leaves of each pair, and the disposition of the formicaria. Rarely both leaves at a node are more or less equal, and in this case both have a formicarium. Also, the rare intermediate leaves have formicaria of correspondingly intermediate size. There is no significant difference between the two species.

In *Ossaea bullifera* (Fig. 2D), the leaves are usually unequal, the larger having a formicarium and the smaller not.

In *Tococa juruensis* (Fig. 2E), the leaves are more or less equal, both having a formicarium; occasionally one leaf of a pair will be smaller, and with a small or no formicarium.

In *Tococa ulei* (Fig. 2F), a young seedling, at the first few nodes, has only one or sometimes neither of a pair of leaves bearing a formicarium. In larger plants, the situation is variable, even on the same plant. The leaves are not markedly anisomorphic, but usually one leaf of a pair is slightly smaller. The larger leaf has a large well-developed formicarium; the opposite, and usually slightly smaller leaf, has either a small formi-

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Fig. 1. General habit of *Maieta guianensis* var. *leticiana* (*Whiffin* 68). x½.

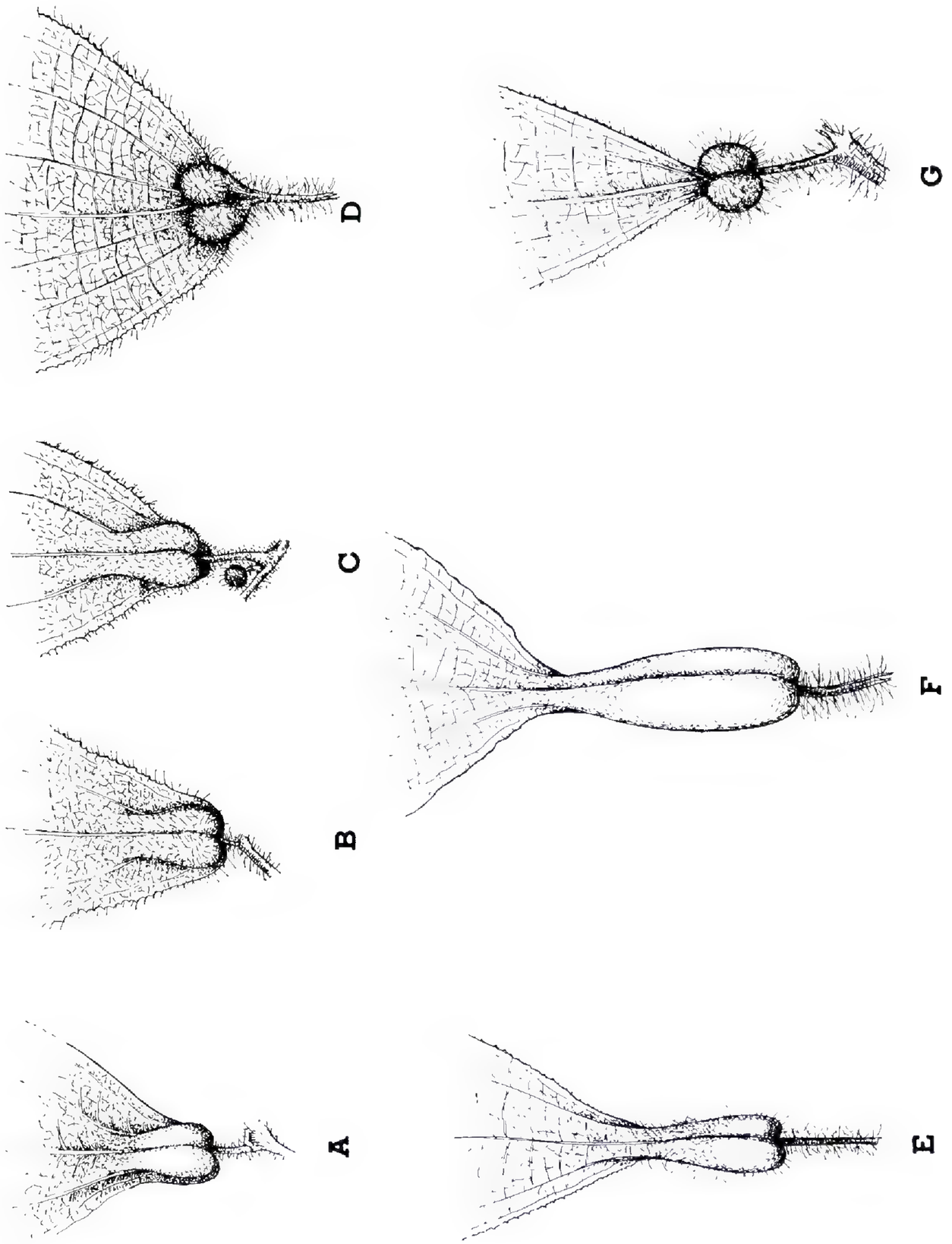

Fig. 2. Details of formicaria. A. *Maieta guianensis* var. *leticiana* (*Whiffin 68)*; B. *M. guianensis* var. *guianensis* (*Whiffin 21*); C. *M. poeppigii (Whiffin 56);* D. *Ossaea bullifera (Whiffin 18);* E. *Tococa juruensis* (*Whiffin 8*); F. *T. ulei* (*Whiffin 15*); G. *T.* aff. *stephanotricha* (*Whiffin 52*). All x½.

carium or none, in about equal frequencies. Occasionally this opposite leaf will have a large formicarium, and at other times a minute, scarcely developed formicarium. The disposition of these various forms on the mature plant seems to follow no set sequence. However, the size of the formicarium seems to vary proportionately with the size of the leaf (though not so markedly as in *Maieta,* where the range in leaf size is greater).

In an unidentified *Tococa* species (aff. *stephanotricha*) (Fig. 2G), the leaves at the lower two or three nodes are markedly unequal, with only the larger leaf of each pair having a formicarium; the leaves at higher nodes are more or less equal, and both have a subspherical formicarium.

The utility of the disposition of formicaria as taxonomic characters has not been extensively examined. Genera such as *Clidemia, Ossaea* and *Tococa* contain both formicarial and non-formicarial species; all three species of *Maieta* are formicarial. The formicaria appear to be a genetic feature, developing in *Tococa guianensis*, for example, even in the absence of ants (Wurdack, pers. comm.).

Observations on living plants indicate that the degree of development of the formicarium varies with the size of the leaf, as might be expected. Species which are markedly anisophyllous (e.g. in *Maieta*) have a formicarium usually only on the larger leaf of a pair, but if the opposing leaves are subequal to equal then both have a formicarium. Species in which the leaves are variably subequal to somewhat unequal (e.g. *Tococa ulei)* usually have a well-developed formicarium on the larger leaf, and an intermediate to no formicarium on the opposing leaf. Species in which the leaves are equal to subequal (e.g. *Tococa* aff. *stephanotricha*) usually have a well-developed formicarium on both leaves of a pair; often, however, there is some slight anisophylly even in these species, and the size of the formicarium will vary correspondingly. Any attempt to use disposition of formicaria as a taxonomic character would have to consider this problem of allometry.

The shape and probably also the placement of the formicaria is often, however, a useful taxonomic character. For example, the shape of the formicarium helps to distinguish *Tococa ulei* from *T. guianensis;* indeed, several *Tococa* species have formicaria with distinctive shapes.

There have been a number of observations on the function and evolution of formicaria (often also called myrmecodomatia). Various different types of relationship exist between ants and plants, as has been outlined by van der Pijl (1955). As regards formicarial melastomes, it appears that the plants provide shelter for the ants (a myrmecodomic relationship); there is no evidence that the plants provide a source of nutrition for the ants (Melin, 1931). It is often postulated that the ants protect the plant from attack by phytophagous insects; this proved to be so in bull-horn acacias, where the removal of the ant colonies was followed by severe defoliation of that acacia (Jansen, 1967). In addition, Jansen (1967, 1969) has noted an allelopathic effect of the ants, maintaining a cleared area

around *Acacia* and *Cecropia* by selectively killing the shoot and lateral branch tips of neighboring plants. However, there is no evidence of such an interaction between ants and formicarial melastomes. Melin (1931) could find no evidence that ants had any effect on the extent of leaf damage caused by phytophagous insects on several *Tococa* plants in middle Amazonia. Field observations in upper Amazonia would, on the whole, support Melin's conclusion. Although the question of allelopathy has not been investigated in formicarial melastomes, the advantage of this would be much less to melastomes growing as small shrubs in tropical rain forest than it is to *Acacia* and *Cecropia* trees in dense young secondary regrowth.

Spruce (1908) postulated a correlation between myrmecophily and inundation; this may have been due to the high frequency of *Cecropia* trees, which show myrmecophily, in the disturbed and often periodically inundated areas alongside the rivers. In the melastomes, however, there appears to be no such correlation. There are few melastomes in the várzea forest (periodically or seasonally inundated forest) and, although the latter are often, but not always, formicarial, there is also a high frequency of formicarial melastomes in the neighboring terra firme forest (upland). Melin (1931) also indicates that the formicarial melastomes which he studied were on the edge of the inundated areas, and in the terra firme forest.

As noted earlier, formicaria are probably produced even in the absence of ants; thus they are part of the genetic make-up of the taxon, and have presumably arisen and been fixed during the course of evolution. From the taxonomy of formicarial melastomes, it would appear that formicaria and the ant-plant relationship have arisen independently on a (small) number of separate occasions. Spruce (1908) attempted to explain this evolution in neo-Lamarckian terms; Melin (1931) could find no explanation in terms of selection as he could find no advantage to the plant from the relationship. At the moment, therefore, the question is not settled, at least in the melastomes. Some authors (Schnell, 1967, and others cited there) have indicated that formicaria may have arisen during evolution from acarodomatia, but the evidence at the moment is not very satisfactory. For selection to have favored the formation and evolution of formicaria, there must have been some selective advantage of the ants to the plant, even if the nature of this advantage is not known at present. Within the variation of the taxon, those forms which allowed or increased this association with ants would have been favored, thus facilitating the fixation of this trait in the population, and later in the taxon. This is similar to the idea of pre-adaptation (Jansen, 1966). A probable outline of the further development of the ant-plant relationship through co-evolution is well detailed by Jansen (1966).

SPECIATION

The modes of speciation in the tropics are probably not different in quality from those in temperate areas (Cain, 1969; Mayr, 1969), although

they may vary in the relative importance of the various different modes. Discussions of speciation in the tropics variously emphasize genetic drift in small populations (Federov, 1966) or natural selection (Ashton, 1969); sometimes other modes such as saltatory non-adaptive evolution (van Steenis, 1969) are postulated, but generally these are unsatisfactory.

The general assumptions concerning the rain forest environment are that it has been relatively stable over geological time, and that as far as plant survival is concerned, it is optimal, thus leading to the idea of a low survival level (van Steenis, 1969) and a consequent lack of selective force. The rain forest environment is complex, not only horizontally (area) but also vertically (different height levels). The greater diversity of niches is part, but probably not all, of the explanation for the greater diversity of species. Among the rain forest trees, especially those which are emergent or which form the canopy, fairly large, though comparatively widespread, populations occur which are probably interbreeding. Ashton (1969) has shown that selection appears to have been a factor in speciation in such trees. However, in understory shrubs, the populations in many cases appear to be rather small and isolated. Thus in the area around Leticia, only one small population of *Ossaea bullifera* and one of *Tococa juruensis* were found. Populations of *Maieta guianensis* var. *guianensis*, *M. guianensis* var. *leticiana*, and *M. poeppigii* were found more often, but each population consisted of one or, at most, a few individuals, and was some distance from any other population. Often, however, two or even all three taxa were found together, indicating a similar ecological preference, although no intermediates were found. The question of how these taxa diverged is less easy to answer. However, some insight may be gained from recent studies by Haffer (1969), indicating that the Amazonian rain forest has not remained stable over a long period of time. He presents evidence that, during the Pleistocene dry periods, rain forest vegetation was restricted to certain forest refugia, which probably corresponded with the present areas of higher rainfall; this theory is useful in explaining speciation and present distribution of Amazonian birds. His theory applies equally well to speciation in rain forest plants. *Maieta guianensis* var. *guianensis* and *M. poeppigii* are widespread across Amazonia; *M. neblinensis* is restricted to Cerro de Neblina, Amazonas, Venezuela, and presumably, after becoming isolated there, has diverged and become distinct. *M. guianensis* var. *leticiana* is found only in Amazonian Colombia and adjacent Perú and Brasil (Whiffin, 1971). Its distribution corresponds to the Napo forest refugium of Haffer (1969) or, perhaps more correctly, to the riverside refugia to the east of the main Napo refugium. This taxon could well have arisen in the forest refugium during one of the Pleistocene dry periods. A number of other melastomes have a very similar known distribution to *Maieta guianensis* var. *leticiana*; these include *Adelobotrys macrophylla* Pilger, *Clidemia ulei* Pilger, *Ossaea bullifera*, *Tococa juruensis*, and *Tococa ulei*.

TAXONOMIC NOTES

The notes given here refer specifically to those formicarial melastomes mentioned above, indicating a number of points of interest found while studying these taxa in the herbarium; notes on other melastomes collected are given by Whiffin (1970).

Maieta Aubl.

Maieta guianensis Aubl., which is widespread from the Guianas across Amazonia to eastern Colombia, Perú, Ecuador, and Bolivia, is fairly common in upper Amazonia. The variation in this latter area is greater than in other parts of its range, and proves to be of interest (Whiffin, 1971). Two varieties of *M. guianensis* are recognized: var. *guianensis* and var. *leticiana* Whiffin; both occur in the area around Leticia. *Maieta poeppigii* Mart. ex Triana is similarly widespread, though less commonly collected throughout its range. The two species are easily separated (Gleason, 1931a; Whiffin, 1971).

Ossaea bullifera (Pilger) Gleason.

This, a distinct species from a restricted area in upper Amazonia, has been very rarely collected. It may be recognized by the following characters: unequal leaves, the larger with a formicarium, the smaller not; young branches densely long-setose, and leaves long-setose on nerves, margin and formicarium, with long, white to golden, setae; inflorescence lax, sparsely long-setose, and hypanthium more densely long-setose, with some setae glandular; calyx lobes long and narrow, green; petals long and narrow, white to translucent; fruit a comparatively large, long-setose berry. This species, originally described in *Leandra*, was later transferred to *Ossaea* by Gleason (1931b); its lax, lateral or axillary inflorescence with a few four-merous flowers may be better placed in *Ossaea*, although its large, fleshy, blue fruit seems a little out of place.

Tococa juruensis Pilger.

This, one of the more easily recognized of the upper Amazonian species of *Tococa*, has only rarely been collected. It appears to have a distribution including upper Amazonian Brasil, Colombia and Perú. It may be recognized by the following characters: young branches, larger formicaria, peduncles, pedicels and hypanthia long-setose pubescent; leaves variously unequal to subequal, most having a formicarium of a size varying with the leaf size; hypanthium terete, the calyx more or less truncate.

Tococa ulei Pilger.

This species is common in the area around Leticia. It has sometimes been confused with *Tococa guianensis* Aubl., which has perhaps slowed down appreciation of its specific limits. *Tococa ulei* is an upper Amazonian species, mostly in Colombia, Perú, and adjacent Brasil.

The shape of the formicarium in *T. ulei* is variable; typically it is longer than broad, but sometimes it is aberrant and more or less hemispherical. The inflorescence is typically racemose, but may be a simple panicle.

Some collections of *T. ulei* may have been misidentified as *T. guianensis*,

which is usually paniculate but may also be racemose; in any case, there is no sharp distinction on this character. As presently understood, *T. guianensis* covers a wide undefined variation, and needs re-definition. Gleason (1931b) has some useful comments on this point. *T. ulei* is a distinct species, however, and may be separated from *T. guianensis* by the following characters: formicarium usually elongate on the larger leaves; leaves often elliptic, sometimes more elongate; hypanthium with ten broad veins; hypanthium at most sparsely hirsute, and usually scurfy or stellate pubescent to glabrous; calyx teeth with a terminal black bristle, which may be entire or divided into three (or rarely more).

Tococa ulei approaches, but is distinct from, the typical form of *T. bullifera* Mart. & Schrank ex DC.; however, some of the varieties placed under *T. bullifera* may be better considered as *T. ulei*. In some respects *T. ulei* is similar to *T. occidentalis* Naud., but is surely distinct; *T. occidentalis* is also similar to *T. guianensis*, but again they are probably distinct. In fact, *T. occidentalis*, a rather neglected species, appears to be somewhat intermediate between *T. guianensis* and *T. bullifera*, the latter in turn connecting with *T. ulei*.

Tococa ulei also approaches *T. discolor* Pilger, but in the latter the leaves are generally broader in shape, and less attenuate at the base. It is also similar to *T. loretensis* Ule, which does not have the black setae on the calyx lobes, but is otherwise very similar, especially in inflorescence form and hypanthium shape. These three upper Amazonian species, *T. discolor*, *T. loretensis*, and *T. ulei*, seem to form a very close group. It has not been possible to examine the types, but type photos are available. At the moment, no valid specific differences between the three can be found.

Tococa aff. *stephanotricha* Naud.

This plant, collected sterile, was not matched, but in vegetative details, especially pubescence, it shows affinities with *Tococa stephanotricha* Naud. and its allies.

COLLECTIONS

Below are listed the specimens collected from the various populations of formicarial melastomes studied in the field; a full set of these is deposited at Kew (K), nearly complete sets at New York (NY) and at Washington (US), and a partial set at Bogotá (COL).

Maieta guianensis var. *guianensis* : *Whiffin 19, 21.*

Maieta guianensis var. *leticiana* : *Whiffin 83* (type), *3, 22, 49, 51, 57, 60, 61, 68.*

Maieta poeppigii : *Whiffin 23, 24, 56, 82.*

Ossaea bullifera : *Whiffin 18.*

Tococa juruensis : *Whiffin 8.*

Tococa ulei : *Whiffin* 4, 15, 25, 50, 62.

Tococa aff. *stephanotricha* : *Whiffin* 52.

For the herbarium study, further material was examined in the herbaria

of the New York Botanical Garden (NY) and of the U. S. National Museum (US).

ACKNOWLEDGEMENTS

The field observations and collections were made while a botanist on the Cambridge Medical Expedition to Colombia, 1968; I am grateful to all those who made that expedition possible (full details are given in Gundry *et al.*, 1970). The taxonomic studies were undertaken while at the New York Botanical Garden, and I am very grateful for the assistance that I received there. I am grateful also to the curators and staff of the U. S. National Herbarium (US) for allowing me to examine the collections there. I am grateful to Dr. B. L. Turner for a number of helpful comments on the manuscript, and to Mr. Geza Knipfer for preparing the illustrations. I am especially grateful to Dr. John J. Wurdack for help with the identifications, for reading the manuscript, and for his help and encouragement.

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NOTES

GALIUM PEDEMONTANUM (BELL.) ALL. (RUBIACEAE) REPORTED FROM OKLAHOMA.—A specimen on loan to the Bebb Herbarium from the Southeastern State College Herbarium, Durant, Oklahoma, proved to be this rare European introduction, first reported in the United States from Kentucky and West Virginia (Bartholomew in *Castanea* 6:141-142, 1941). This specimen, *John and Connie Taylor 6419*, was collected along a roadside 6 miles southeast of Eagletown, McCurtain County, April 26, 1970.—*Cheryl A. Lawson, Bebb Herbarium, Department of Botany and Microbiology, University of Oklahoma, Norman, Oklahoma 73069.*

THREE GRASSES NEW TO GEORGIA: ERIOCHLOA GRACILIS, SETARIA FABERII, LEPTOCHLOA UNINERVIA (GRAMINEAE).—Three grasses, probably not native to Georgia, seem firmly established at separate localities within the state.

Specimens of *Eriochloa gracilis* (Fourn.) Hitchc. were sent to the University of Georgia Herbarium for naming. They were from the southwestern Coastal Plain of Georgia, where the species is described as slowly spreading but a vigorous weed in ditches and in and around fields of cotton, corn, and peanuts. Hitchcock (1950) reports this species as "often a weed in fields" and shows a distribution of southern California to western Texas and Oklahoma. Small (1933), Fernald (1950), Gleason and Cronquist (1963), and Radford, et al. (1968) do not report it for their areas, which includes all of the United States east of the Mississippi River.

Setaria faberii Herrm. is known as a vigorous weed, now widely distributed (Gleason and Cronquist, 1963), mostly in the central part of the eastern half of the United States (Hitchcock, 1950). Previously it has been reported southward only into Arkansas (Hitchcock, 1950), and into Tennessee, throughout most of North Carolina, and in central north South Carolina (Radford, et al., 1968). The new locality is in the southeastern Piedmont of Georgia, where it is abundant in abandoned fields and roadside cuts and ditches.

Leptochloa uninervia (Presl.) Hitchc. & Chase has been found near the seacoast, distributed in a broad, low, open area between a woods and the main highway across White Marsh Island east of Savannah, Georgia. Many plants had been mowed, but had grown vigorously afterward and were flowering and fruiting. The nearest localities reported by Hitchcock (1950) are in Mississippi and North Carolina. Radford, et al. (1968) record the species from Mississippi and from the northern part of the Piedmont of North Carolina.

The *Eriochloa* and *Setaria* are likely to become important weeds over large areas of the Southeast. Specimens of the three species are on file in the University of Georgia Herbarium: ERIOCHLOA GRACILIS (Det. by

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W. H. Duncan), *Hull Andrews*, ca. 26 June 1970, Lee Co., Ga.; SETARIA FABERII, *W. H. Duncan, 23456*, 1 Aug. 1970, just east of Washington, Wilkes Co., Ga.; LEPTOCHLOA UNINERVIA, *W. H. Duncan 23451*, 31 July 1970, Chatham Co., Ga.—*Wilbur H. Duncan, Department of Botany, University of Georgia, Athens, Georgia 30601.*

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NEW COMBINATIONS IN HOFFMANSEGGIA CAV. AND CAESALPINIA L.

1. HOFFMANSEGGIA **glauca** (Ort.) Eifert, comb. nov.

Larrea glauca Ort., N. Hort. Matrit. Decad. 15, pl. 2. 1797.

Hoffmanseggia falcaria Cav., Icones Plant. 4:63, pl. 392. 1798 ("1797").

Caesalpinia glauca (Ort.) Kuntze, Rev. Gen. Plant. 3(2):53. 1898.

C. chicamana Killip & Macbr., Publ. Field Mus. Nat. Hist., Chicago, Bot. Ser. 13(3):191. 1943.

When Cavanilles described *Hoffmanseggia falcaria*, he clearly stated that it is the same species as *Larrea glauca* Ort., but his remark was overlooked by all subsequent workers, with the exception of Kuntze, who did not consider *Hoffmanseggia* Cav. distinct enough from *Caesalpinia* L. and made the new combination in *Caesalpinia*. After studying the genus *Hoffmanseggia* Cav., I concluded that it is sufficiently distinct from *Caesalpinia* L. to warrant generic recognition. Because my revisionary work can not appear in print for some time, I make this new combination available for this species which is widely distributed in the arid and semiarid regions of the New World. A list of synonyms is given by Britton in the *North American Flora* (vol. 23, p. 311. 1930; under *Larrea densiflora*), to which list the above synonyms have to be added.

2. CAESALPINIA **peninsularis** (Britton) Eifert, comb. nov.

Larrea peninsularis Britton, N. Am. Fl. 23:311. 1930.

Hoffmanseggia peninsularis (Britton) Wiggins, Contrib. Dudley Herb., Stanford Univ. 4:18. 1950.

This is a species of *Caesalpinia*, which begins to flower at a very early stage while still herbaceous. Older specimens are, however, definitely woody, a character which occurs only occasionally, and then only at the base of the shoot, in two species of *Hoffmanseggia*. Also, the lunate pods are unknown in the latter genus, but they are characteristic of some parvifoliolate species of *Caesalpinia*, most of which were formerly included in *Hoffmanseggia*. These species, the closest relatives of *C. peninsularis*, are

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the following: *C. drummondii* (Torr. & Gray) Fisher, in North America, and *C. pumilio* Griseb., *C. ternata* (Phil.) Macbr., *C. viscosa* (Ruiz & Pav.) Macbr., *C. egena* (Macbr.) Macbr., and a still unnamed Peruvian species in South America.—*Imre J. Eifert, Department of Botany, The University of Texas, Austin, Texas, 78712.*

VERNONIA CRINITA RAF., A SYNONYM OF V. ARKANSANA DC. (COMPOSITAE)—The well known *Vernonia* of the Ozarks of Missouri and Arkansas, *V. crinita* Raf. in the regional and state manuals of the area (Fernald, 1950; Gleason and Cronquist, 1963; and Steyermark 1963), is incorrectly named. Gleason (1922), in his revision of the genus *Vernonia* in North America, appeared to indicate that *V. crinita* Raf., New Flora N. Am. 4:77, was published in October with the notation "(?0) 1838," and that the name *V. arkansana* DC., Prodr. 7:264, appeared in the literature in December, 1838 with the symbol "(?D) 1838." After studying some of Rafinesque's correspondence, Barnhart (1907) had earlier determined that part 4 of Rafinesque's New Flora N. Am. was actually available for distribution late in 1838 but before December and not in 1836 as listed on the frontispiece of the entire work. Shinners (pers. com.) suspected that Gleason may have consulted Barnhart about the valid publication dates and that these were Barnhart's best opinion at that time. The International Code of Botanical Nomenclature provides that the title page date may not be accepted if it can be shown to be incorrect.

It is therefore necessary to determine the date of publication for *Vernonia arkansana* DC. Volume 7 of DeCandolle's Prodromus appeared in two parts: pages 1-330, late April 1838 and pages 331-801 late December 1839 (Stafleu, 1967). Gleason's "(?D)" was correct but the year was not, as the December was for part 2 which was not relevant for *V. arkansana* DC. (7:264).

There can be no doubt that both DeCandolle's and Rafinesque's description refer to the same *Vernonia*. It would not be possible for their descriptions to fit any other species of *Vernonia* and no one familiar with the genus has ever suggested this. In conclusion, *Vernonia arkansana* DC., Prodromus 7:264, late April 1838 is earlier than *V. crinita* Raf., New Flora N. Am. 4:77, late in 1838 and possibly October. Therefore, *V. arkansana* DC. is the earliest legitimate name. It is unfortunate when a well-known name must be changed but it is necessary for nomenclatural stability.

I want to thank the late Dr. L. H. Shinners for his assistance with this nomenclatural problem. This study was supported by National Science Foundation Grant GB 7208.—*S. B. Jones, Jr., Department of Botany, University of Georgia, Athens, Georgia 30601.*

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ROTALA INDICA (LYTHRACEAE) IN LOUISIANA.—During a recent visit to a rice field near Crowley to collect aquatic plants for class use I noted an individual of a species that was quite unknown to me. Bringing the plant back to the laboratory, I soon identified it as *Rotala indica* (Willd.) Koehne, an Asiatic species previously recorded, in the conterminous United States, only from Butte County, California (H. L. Mason, A Flora of the Marshes of California, p. 602. 1957). On a return visit to the Crowley site I found, after a thorough search, only four more individuals of *R. indica*; these were left *in situ* to provide a seed source that would, hopefully, help to keep the species a part of the field's flora. All the plants were growing in clear water up to 6 inches deep. All were unbranched. They were rooted in soft mud among *Chara* and were associated with *Ammannia coccinea, Bacopa repens, Dopatrium junceum, Eleocharis atropurpurea, E. obtusa, Heteranthera limosa, Ludwigia decurrens, Rotala ramosior,* and *Sphenoclea zeylanica*. Collection data are as follows: in rice field, Rice Experiment Station, 2.5 miles NE of Crowley, Acadia Parish, *Thieret 36102* (LAF), 19 September 1971.—*John W. Thieret, University of Southwestern Louisiana, Lafayette 70501.*

NEW COMBINATIONS AND A NEW SPECIES IN HELENIUM (COMPOSITAE—HELENIEAE).—Three new combinations and one new species are reported at this time since a forthcoming systematic study of *Helenium* (A Chemo-systematic and Cytotaxonomic Study of *Helenium* Sect. *Tetrodus* (Compositae), Ph.D. dissertation, The University of Texas at Austin, 1971) will probably be at least one year before appearing in print. Two of the new combinations and the new species belong to Sect. *Tetrodus* and the other new combination (*H. apterum*) belongs to Sect. *Hecubaea*. The present work was supported by an N. S. F. Traineeship presented through the University of Texas at Austin.

HELENIUM **chihuahuensis** Bierner, sp. nov. A *H. mexicano* foliis irregulariter laciniatis vel saltem irregulariter lobatis, partibus supernis internodiorum breviter alis decurrentibus, pubescentia pedunculorum ligularumque sparsa. MEXICO: Chihuahua. Cima, *H. LeSueur 987,* 9 Jul 1936 (Holotype US; isotypes MO, PH, UC). Fig. 1.

Annual herbs with several stems or one stem originating at the base,

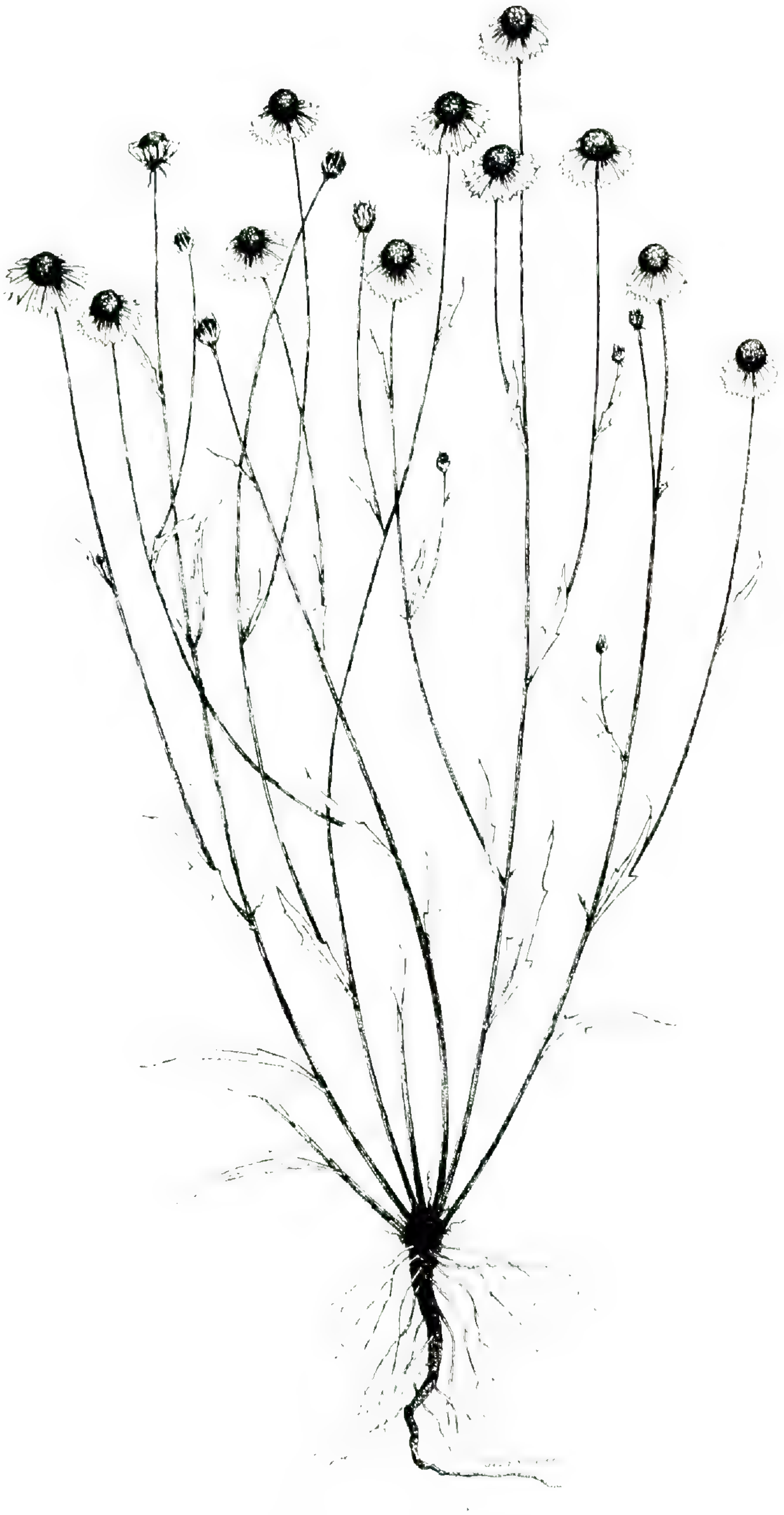

Figure 1. *Helenium chihuahuensis Bierner*, sp. nov.

sparingly branched above, 2.7—7.8 dm tall. Stems glabrous to very sparsely pubescent. Peduncles 2—12 cm long, only slightly broadened at the top, sparsely pubescent. Leaves variable, but most irregularly laciniate or at least irregularly lobed, apices rounded to obtuse or sometimes acute, glabrous to very sparsely pubescent, midrib prominent, the lateral veins obscure, hardly decurrent at all along the stem. Heads few to several, globose to slightly ovoid, 8—14 mm high, 8—14 mm wide (excluding rays). Receptacle globose to ovoid, 2.5—6.0 mm high, 3.0—6.0 mm wide. Involucre of two series of lanceolate bracts, the outer exceeding the inner and united at the base, reflexed at anthesis, sparsely pubescent. Ray florets 14—15, ligules 4.5—13.0 mm long, 2.5—6.0 mm wide, yellow, glabrous to very sparsely pubescent. Disc corollas 5-lobed, cylindrical to cylindric-campanulate, 1.6—2.7 mm long, 0.8—1.1 mm wide, yellow with purple lobes. Achenes 1.2—1.7 mm long, 0.5—0.7 mm wide, pubescent mainly along the 6 ribs. Pappus scales 6, 0.7—1.2 mm long (including the terminal awn which is ca 1/3 the length of the body), 0.3—0.5 mm wide.

Distribution: Central and northwestern Chihuahua, Mexico. From label data, apparently occurring in ditches and around ponds at elevations of 6,000—7,000 ft. June—September.

HELENIUM ELEGANS DC. var. **amphibolum** (Gray) Bierner, comb. nov.

Helenium amphibolum Gray, Proc. Am. Acad. 9:202. 1874.
Heleniastrum amphibolum (Gray) Ktze., Rev. Gen. Pl. 342. 1891.
Helenium stenopterum Rydb., N. A. Fl. 34:123. 1915.

This taxon may be distinguished from the closely related var. *elegans* by its irregularly toothed or lobed lower leaves, usually longer peduncles, larger heads and more southern distribution.

HELENIUM MICROCEPHALUM DC. var. **ooclinium** (Gray) Bierner, comb. nov.

Helenium ooclinium Gray, Proc. Am. Acad. 9:202. 1874.
Heleniastrum ooclinium (Gray) Ktze., Rev. Gen. Pl. 342. 1891.

This taxon may be distinguished from the closely related var. *microcephalum* by its longer peduncles, longer ligules, larger heads and more southern distribution.

HELENIUM **apterum** (Blake) Bierner, comb. nov.

Hecubaea aptera Blake, Contrib. U. S. Nat. Herb. 22:649. 1924.

This species has been transferred to *Helenium* Sect. *Hecubaea* because of its obvious relationship to *H. scorzoneraefolium*; however, it may be distinguished from the latter by its leaves which are decurrent for only a few millimeters below the point of attachment to the stem, possession of pappus scales and sterile ray florets.—*Mark W. Bierner, Department of Botany, The University of Texas at Austin, Texas 78712; present address: Department of Botany, University of Tennessee, Knoxville, 37916.*

ADVENTIVE RECORDS OF ERIOCHLOA CONTRACTA (GRAMINEAE) IN THE UNITED STATES.—The main distribution of *Eriochloa contracta* Hitchc. is Kansas and Missouri, south to Louisiana and Texas, and west to Arizona and Colorado. The species is occasionally adventive elsewhere. A new record for Indiana is as follows: *E. E. Terrell* and *F. G. Meyer 4319*, Aug. 28, 1970, abundant for about 50 yards along roadside of route 460 about 0.2 mile west of its junction with route 462, Harrison County, Indiana (distributed to IND, NA, US). As it was abundant at this southern Indiana site, it is possible that it may persist or spread. G. N. Jones (Flora of Illinois, 3rd ed., 1963) reported the species from two counties in southern Illinois.

There are specimens in the U.S. National Herbarium which represent new states not listed in Hitchcock's "Manual of Grasses of the United States" (1951, rev. by Chase). These represent adventive occurrences and are as follows: ALABAMA. *C. M. Wilson*, July, 1947, "eastern central Alabama"; MISSISSIPPI: *W. C. Young*, Sept. 1955, 40 acres or more in natural stand near Clarksdale [northwest]; *H. J. Jacob 784*, Aug 29, 1954, dry soil, Doddsville, Sunflower County [northwest]. In addition, there are three collections from three counties in central California which also represent adventive or introduced occurrences. Munz & Keck (A California Flora, 1968) noted it as occasional in the state.

Hitchcock's Manual cited it as being adventive in Virginia, apparently on the basis of the following specimen: *S. F. Blake 11675A*, Aug. 7, 1933, one plant only in center of unfinished new highway near Glencarlyn, Arlington County, Virginia. This single plant collection should not have been considered an extension of range.—*Edward E. Terrell, New Crops Research Branch, Crops Research Division, U.S.D.A., Beltsville, Maryland 20705.*

TWO NEW SPECIES OF CHAMAESARACHA (SOLANACEAE) FROM TEXAS.—During a revisionary study of *Chamaesaracha,* two heretofore undescribed species were encountered. My revision of the genus will not appear for several months, and it seems advisable to report these taxa at this time. Also, both species have appeared in Correll and Johnston's Manual of the Vascular Plants of Texas (1970; p. 1741), and this will validate the two taxa.

CHAMAESARACHA **edwardsiana** Averett, sp. nov. Herba perennis. Folia subsessilia 2.7—7.0 cm longa 0.7—1.5 cm lata lance-linearia vel rhombica integra vel plus minusve lobata glabra. Chromosomatum numerus $n = 24$. Type: TEXAS: Travis Co.: ½ mi E of Pedernales River on Hwy 620, 28 June 1968, *J. E. Averett 289* (Holotype, TEX; isotypes, GH, MO, SMU).

Primarily on limestone soil in the Edwards Plateau of Texas. The species is probably most closely related to *C. coronopus*, differing from the latter in having glabrous, entire leaves. It is also related to *C. pallida,* differing in the narrow, linear-lanceolate, glabrous leaves.

CHAMAESARACHA **pallida** Averett, sp. nov. Herba perennis. Folia subsessilia 2.0—3.5 (—4.0) cm longa 1.0—1.5 cm lata rhombica vel late lanceolata integra vel sinuato-repanda dense stellato-pubescentia. Chromosomatum numerus $n = 36$. Type: TEXAS: Presidio Co.: SW edge of the Cuesta del Burro Mts., 35 mi SW of Marfa on Hwy 2810, 24 July 1966, *J. E. Averett 155* (Holotype, TEX; isotypes, GH, MO, SMU, US).

Chamaesaracha pallida is a rare species of Trans-Pecos Texas and northern Mexico, mostly confined to limestone soils. The species has its closest affinity with *C. edwardsiana*. However, a dense stellate pubescence is typically found in *C. pallida*. Some specimens of *C. edwardsiana* and *C. coronopus* have considerable pubescence, but not so much as *C. pallida*.—*John E. Averett, Department of Botany, The University of Texas, Austin, Texas, 78712; present address, Department of Biology, University of Missouri-St. Louis, 63121 and Missouri Botanical Garden.*

A NEW VARIETY OF CAREX BICKNELLII FROM ARKANSAS.—Three collections of *Carex bicknellii* Britt., by Dr. Delzie Demaree from river terraces in Prairie and Lonoke Counties, Arkansas represent a superficially puzzling variation because of its resemblance, in its large, nearly nerveless perigynia, to *C. brittoniana* Bailey. The latter characteristic and the fact that the perigynia are only partially translucent, are also suggestive of the northeastern *C. merritt-fernaldii* Mack., in which, however, the perigynia are much smaller (4—5 X 2.5—3.5 mm). This variant may be known as:

CAREX BICKNELLII Britt. var. **opaca** F. J. Herm., var. nov. A varietate typica recedit perigyniis valde concavis (margine externo excepto) ventraliter vix aut haud nervatis, inter achaenium et alam suberosis, margine interno viride, externo hyalino. ARKANSAS: Prairie Co.: *Demaree 60141*. Holotype: US.

Differing from the typical form in having the perigynia (5.5—7 mm long, 4—4.75 mm wide), strongly concave rather than "very flat," opaque (except for the outer margin), faintly if all nerved ventrally, corky between the achene and wing, and the inner margin green, only the outer hyaline.

ARKANSAS: PRAIRIE COUNTY: river terraces (never plowed), rice region, Hazen, May 10, 1969. *Delzie Demaree 60141* (HOLOTYPE: US), *57815* (NY), *55595* (G), and low, wet ground, Ulm, May 9, 1937, *Delzie Demaree 14915* (Hermann Herb.); LONOKE COUNTY: common on terraces in wet areas, rice region, Charlisle, *Delzie Demaree 57794* (USFS).—*Frederick J. Hermann, Forest Service Herbarium, Colorado State University, Fort Collins, Colorado, 80521.*

DOCUMENTED PLANT CHROMOSOME NUMBERS 1972:1[1]

GARY H. MORTON

Department of Botany, The University of Tennessee, Knoxville, 37916; present address: Florida Junior College, South Campus, Jacksonville, 32205

The following work was initiated as an introduction to this phase of biosystematics. I am grateful to the Society of Sigma Xi for a travel grant to collect most of the *Solidago* here reported and to Bob MacDonald and the U.T. Arboretum for providing space in which to grow these plants.

ASTERACEAE (COMPOSITAE)

ARTEMISIA ABSINTHIUM L. [a](Fig. 1) n=9. Tenn., Anderson Co.; *G. Morton 2888* (TENN, SMU).

CACALIA ARTIPLICIFOLIA L. [a](Fig. 2) n=26. Tenn., Union Co.; *G. Morton 2880T-5* (TENN) and *G. Morton 2880T-6* (SMU). In both plants figures of n=24 were seen.

COREOPSIS TINCTORIA Nutt. [a](Fig. 3) n=12. Tenn., Anderson Co.; *G. Morton 2889* (TENN) and *G. Morton 2890* (SMU).

EUPATORIUM PERFOLIATUM L. [a](Fig. 4) n=10. NJ, Ocean Co.; *G. Morton 2900* (TENN).

SOLIDAGO BICOLOR L. [a](Fig. 5) n=9. NJ, Hunterdon Co.; *G. Morton NJ-3* (TENN).

SOLIDAGO BRACHYPHYLLA Chapm. [b](Fig. 6) n=18. Fla., Holmes Co.; *G. Morton FL-9* (TENN, SMU). This is the first reported tetraploid plant for this species.

SOLIDAGO GATTINGERI Chapm. [a](Fig. 7) n=9. Tenn., Rutherford Co.; *G. Morton TN-37* (TENN).

SOLIDAGO JUNCEA Ait. [a](Fig. 8) n=9. Penn., Bucks Co.; *G. Morton 2897* (TENN) and *G. Morton 2896* (SMU).

SOLIDAGO JUNCEA f. RAMOSA (Porter & Britt.) Fern. [c](Fig. 9) n=9. Penn., Bucks Co.; *G. Morton 2899* (TENN) and *G. Morton 2898* (SMU).

SOLIDAGO ODORA Ait. [a](Fig. 10) n=9. NJ, Ocean Co.; *G. Morton 2901* (TENN).

SOLIDAGO PINETORUM Small [a](Fig. 11) n=9. NC, Anson Co.; *G. Morton NC-8* (TENN).

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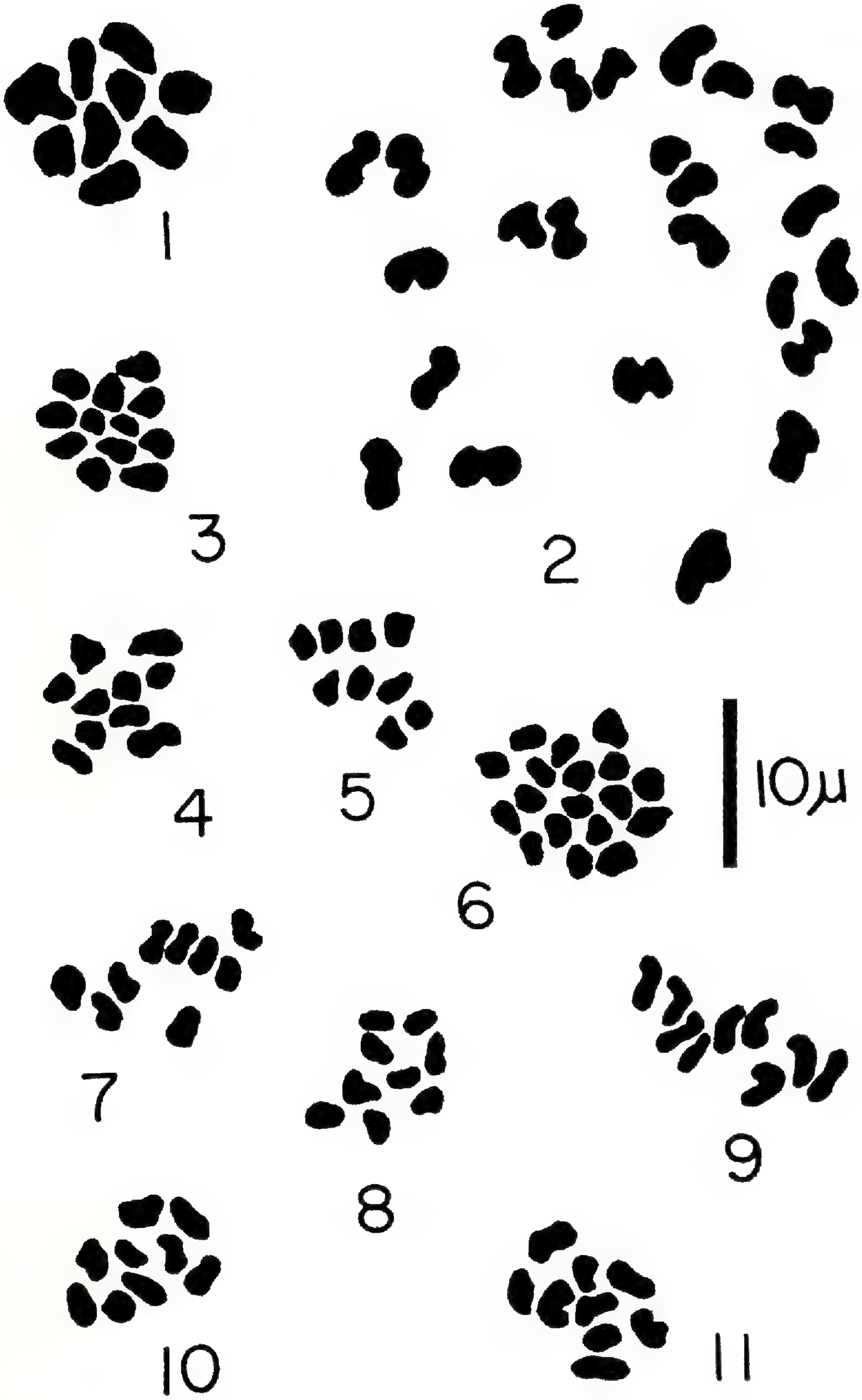
[1] Contribution from the Botanical Laboratory, The University of Tennessee, N. Ser. 371.

[a] Species for which a similar chromosome count has been published previously.

[b] Species for which a chromosome count differing from this one has been published previously.

[c] Species for which no chromosome count has been published previously.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DOCUMENTED PLANT CHROMOSOME NUMBERS 1972:2

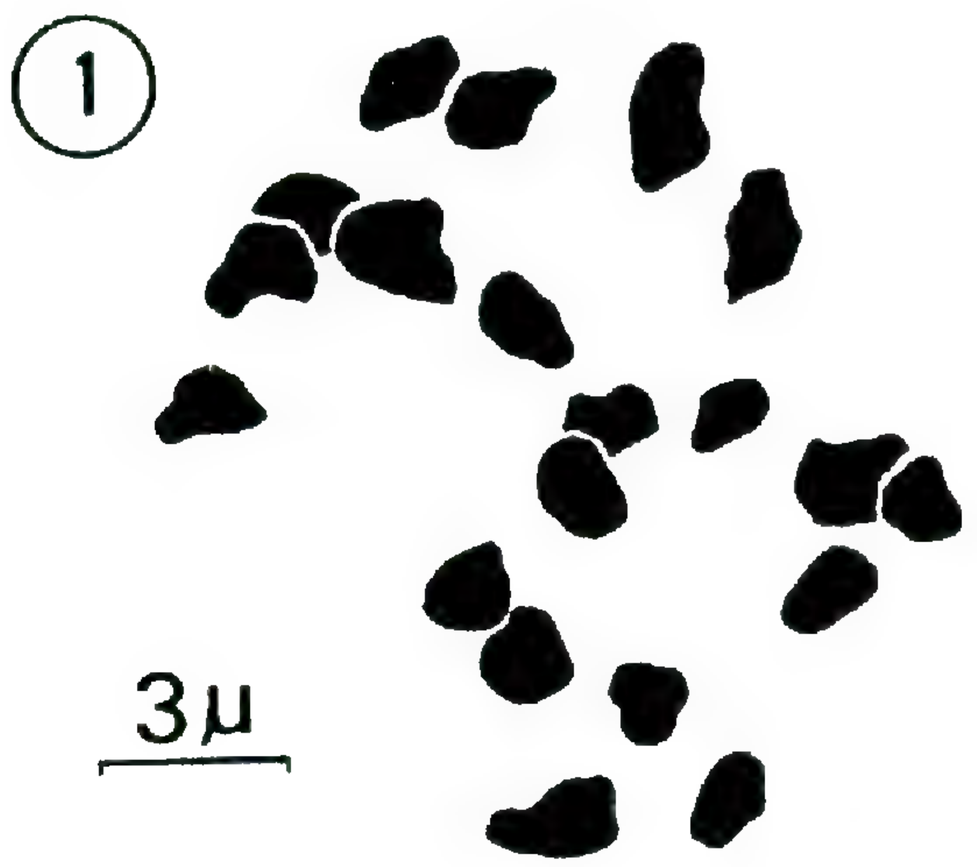
TOD F. STUESSY
Academic Faculty of Botany, The Ohio State University, Columbus, 43210

JOHN L. STROTHER
Department of Botany, The University of California, Berkeley, 94720

ASTERACEAE (COMPOSITAE)

CALYPTOCARPUS VIALIS Less. $n=12$. Mexico, Nuevo León, *Stuessy & Renold 1280* (TEX); Mexico, Tamaulipas, *Stuessy & Renold 1271* (TEX); Texas, Travis Co., *Stuessy 1297* (TEX). These three counts substantiate the previous report of $n=12$ for this species (Turner, Ellison and King, 1961, Am. J. Bot. 48:221).

SYNEDRELLA NODIFLORA (L.) Gaertn. (Fig. 1) $n = 20$. Nicaragua, Granada, *Stuessy 617* (TEX). This taxon has been reported previously as $n = 19$ (Gajapathy, 1962, Proc. Ind. Acad. Sci. 55:72), $2n = 36$ (Mangenot and Mangenot, 1962, Rev. Cytol. Biol. Veg. 25:431), $n =$ ca. 20 (Turner in King, 1965, Phytologia 11:218), $2n = 40$ (Harvey, 1966, Taxon 15:163), $n = 20$ (Mehra and Remanandan, 1969, Taxon 18:438), and $n = 19$ or 20 (Powell and King, 1969, Sida 3:320). The present count of $n = 20$ further documents the 20 level in what may be an aneuploid series of $n = 18$, 19 and 20.



BOOK NOTICES

KEYS TO THE VASCULAR PLANTS OF THE BLACK GAP WILDLIFE MANAGEMENT AREA, BREWSTER COUNTY, TEXAS. Wm. F. Mahler. Third edition, 1971. 109 pp. Paperback. SMU Book Store, Box 759, Dallas, Texas, 75222. $3.00 ($3.65 postpaid).—This paperback edition is the first edition available for distribution. The first (1969, Ditto) and second (1970, Xerox) editions were produced in limited quantities for the Museum and Field Investigations Course sponsored by the Department of Biology, SMU and the Dallas Museum of Natural History.

REEVES' FLORA OF CENTRAL TEXAS. Robert G. Reeves. Second edition. 1972. Paperback. Prestige Press, P.O. Box 2504, Fort Worth, Texas, 76125. $6.85 ($7.50 postpaid).

SHINNERS' SPRING FLORA OF THE DALLAS-FORT WORTH AREA, TEXAS. Lloyd H. Shinners. Second edition. Edited by Wm. F. Mahler. 1972. Paperback. Prestige Press, P.O. Box 2504, Fort Worth, Texas, 76125. $7.25 ($8.00 postpaid).

LOWELL DAVID FLYR, 1937-1971

"OH GOD, WHAT A HOPELESS TEXAN AM I!"

Letter from Oxford, England; 9 Jan 1965

David was a *Texas* botanist. He'd like that said first and underlined. Suckled on the dry teat of a panhandle town in Texas ("Stratford, write Stratford"; his ghost is in me!), dying by his own hand at thirty three, we wept wondering why? For he was gifted; played Bach, picking it out on the piano precocious child ("clearly genius" his music teacher told me once, confiding in our aloneness, knowing I'd tell David later, and I did, laughing it over coffee; "sheit" he said, drawn out long through grinning teeth, pleased, warmed to his listening, "I'm the greatest Turner; better watch your women.") That David, I used to think he's smarter than us all, the way he carries his 1575 (highest-on-the-campus) GRE score in his hip pocket like it were nothing 'cept an old photograph out of focus someone took once, catching him bent over at the hips looking at *Leucophyllums*, Texas Sage (*L. frutescens*). He was a westerner born out of his age; "maybe I'd of made it years before . . .", he remarked once, "just standing around waiting for time to catch up." He'd make a little remark like that once a day or so and I'd be haunted for hours wondering what he'd meant.

Big man; large boned; carrying fat sometimes up to maybe two fifty; and later, a couple of months maybe, he'd show up sixty pounds off in an ivy league suit speaking impeccable English chuckling with that little, deep-throated dog whimper endemic to him, he'd say, "remember me Dr. Turner? I'm full of wonderful vacuums", referring to shock treatments for depression he'd taken voluntarily because it's good for the thesis, works out phylogenies, "didn't you know my mind was programed Fortran, needed plugging in."

But it did; within two months after shock treatment he wrote his entire thesis, handing it to me intact, saying, "Here it is; you don't have to read it; it's fine." I said, "ok, don't get bitchy." Glancing over it briefly, remarking of a sudden, "I call that piece a wonder, now", (remembering a line from Browning's *Last Duchess*; oh, David loved me for that; he was an intellectual first, maybe even only.)

About his thesis: for six years David wandered in and about the Botany Building at the University of Texas at any hour irregularly, taking courses whenever he couldn't talk his way out of them; disappearing suddenly into the field for no reason 'cept as how he wanted away, collecting whatever he couldn't avoid, pressing mostly *Leucophyllum* at first, but switching by degrees to *Brickellia* because, as I put it, "it grows daffodil in desert rock and nobody really gives a damn but you." And he gathered a lot of field data about his genus, keeping it all in his head, rarely, if ever, making notes, except in contempt; and he retrieved it all, six years of it, in two

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SIDA 5(1): 54. 1972.

months time starting from scratch he emptied his vacuum. I was astonished.

But more than once! He astonished me on our first field trip. We were in Big Bend National Park (where he always took off to in moments of stress) and him not knowing beans about botany, "not even the name of a Compositae?" I asked.

"No, but I'm-a-willing to learn."

He talked that way informally (to me at least; I took it to be his desire for identity with dirt farmers and things of his childhood and his father sitting on a tractor and David right there walking barefoot understanding everything excepting why he'd died when he was four: after that memories, only memories and long furrows). Leaning back, wickedly arrogant, David would ask "what's that?" at 30 miles an hour along the roadside, "*Engelmannias, Lindheimeras, Berlandieras*" I'd respond, "lotsa genera". And I think, swear, he learned to recognize and name maybe 300 species on that one trip, bragging how he'd have my job some day except that he wanted Professor Shinners' position at SMU. *He* was his real hero.

It is appropriate then that David's obituary be buried here in SIDA. Lloyd was the first to recognize David's interest in botany; indeed, he instilled it. When Shinners suggested that he work under my direction for a Ph.D., Lloyd wrote to me separately stating, "If successful, the effort you put into the development of David as a taxonomist will be worth that effort you might put into at least ten other ordinary doctorates." And whether this might have been so or not isn't important. What is important to me is that *I* am a better taxonomist, teacher, person; having known him I carry a deeper sense of joy, laughter and, what other word, tragedy. He stood the test well: deeply sensitive and proud of his heritage, I never saw him flinch, beg excuses, cover his eyes with shakey fingers. David wore his profound (psychotic) depression so lightly (to me it was always so) that most of us mistook it for cautious wisdom, or aloofness born of the prairie or whatever else he managed to make it through the day with (and I'm thinking now that when he first corrected my illiterate pronounciation of the word façade he did so simply because that word was important to him personally).

I never understood that side of David except possibly once, just once I perhaps came close. We were atop the University Tower looking over the city, "gaining perspective" he said "sometimes when I'm depressed I come up here and gaze westward looking to the plains, seeking solace with my ancestors."

"But it doesn't help." I said "David, it doesn't help, I feel sick to my stomach, I've a barnacled anchor heavy on my shoulders, I can't breathe, I have no perspectives, I'm depressed, for the first time in my life, David, I am deeply depressed." David looked at me with a kind of eye-sharing we'd not experienced before, and he said, quite slowly, as though I might only this once hear the message, "Dr. Turner, that's the way I feel *all* the time". I cried, and I think he understood. Neither of us ever mentioned the moment again.

In Memory

Leucophyllum flyrii Turner, sp. nov. HOLOTYPE (TEX, isotypes to be distributed): ca 4.5 E of Laguna Seca, 29 Jul 1966, *Flyr 1113*.

Species unica foliorum basi 3 mm. lato (aliae omnes maxime 2 mm).

Shrubs up to 1.6 m tall, much and somewhat intricately alternately-branched, especially above; foliage dense and somewhat canopy-like; bark dark grey-brown, conspicuously rugose or ridged and furrowed on oldest branches, inconspicuously rugose above; petiole scars and leafless somewhat spiny lateral branchlets tending to persist on old branches; branches leafless, except for the terminal 6-10 cm; densely pubescent when young, gradually becoming glabrous after several growing seasons; leaves alternate, densely crowded (internodes often less than 1 mm long), sessile, the leaf base often 1 mm or more across at attachment to stem; blade shape varying but most characteristically obovate-spatulate, broadest 1/5-1/4 of distance from apex and then narrowed very gradually with nearly straight sides to the base; distally: either rounded or somewhat angled from the widest portion to the obtuse or somewhat acute apex; mature blades (10-)12-19 mm long, 5-9 mm wide; midrib slightly raised on the lower surface except near the apex, not visible above; no lateral veins visible; blade rather thick and felt-like by the dense mostly closely appressed pubescence; pubescence of young stems, leaves, and pedicels very complex: of many erect, closely-crowded tufts, each consisting of a central axis with many radii (or each tuft, through suppression of the axis, merely a pile of these lateral hairs), in older leaves the tufts becoming obscured and the surface tending to appear a tangle of very fine hairs; flowers alternate or sometimes subopposite in the leaf axils, borne on pedicels 2 mm long and conspicuously more pubescent than the calyx, which is divided nearly to the base and consists of 5 lance-oblong sepals, 4.5-6.0 mm long, with somewhat attenuate tips; corolla appearing funnelform when pressed but dorsiventrally compressed and appearing subcylindrical in lateral view, narrowly campanulate or funnelform in dorsal view, 5(-6)-lobed and somewhat 2-lipped, 3(-4) lobes below the middle sparingly pilose, the middle 1(-2) extended, the lateral somewhat reflexed, the upper two less separate from each other than from the others; whole corolla up to 25 mm long, the lobes ca 6-7 mm long, the tube within almost wholly beset with many very small and dark purple spots up to 1 mm across, but intermixed with these are some oblong, dark-colored nectaries, internally sparingly pilose on or near the anterior lobe; veins somewhat prominent on tube, about 3 per lobe; stamens 4 or sometimes 5, alternating with the corolla lobes, didynamous, the posterior pair longer, filaments ca 8-9 and 11 mm long as measured from base of corolla, adnate up to half their length to the corolla, glabrous; anthers up to 4 mm long; ovary somewhat compressed laterally, with small swellings (nectaries?) around base, short pilose (or hairs somewhat branched) near summit, locules unequal (anterior larger); style ca 11 mm long, sparingly pilose,

stigma bilamellate; capsule 4.5 mm high, woody but thin-walled (less than 0.2 mm in diameter).

Distribution: one or two localities northeast of San Luis Potosí, S.L.P., Mexico.

Leucophyllum flyrii is known from a small area a few miles east and northeast of the city of San Luis Potosí. F. W. Pennell first discovered it at San Pedro which lies in low hills about 12 miles east of San Luis Potosí. As is true of other desert mining areas, very little woody vegetation remains in the area of San Pedro. I was unable to find *L. flyrii* there. Rzedowski, who collected San Luis Potosí rather thoroughly, made two collections of this species east of Laguna Seca, which lies a few miles north of San Pedro. After one unsuccessful search, I obtained from Dr. Rzedowski (*in litt.*) a detailed locality and was able to find the shrubs in flower.

The very restricted range of this species suggests two possibilities: that it is limited by some edaphic factor, or that its present range is but a fragment of a larger former range.

The species occurs at the southeastern edge of the more or less continuous distribution of *Leucophyllum* over the desert plateau of northern Mexico. To the south and east, increasing rainfall, with or without increasing elevation, allows development of a vegetation that does not include *Leucophyllum* until an isolated semi-arid area in Queretaro and Hidalgo is reached.

Specimens Examined: MEXICO. *San Luis Potosí*: San Pedro, Sierra Madre Oriental, 2150-2200 m, 29 Jul 1934, *Pennell 17735* (BM, F, MICH, NY); 8 km NE of Laguna Seca, 2250 m, 30 Aug 1955, *Rzedowski 6335* (TEX).

Except for the specific name, I have culled this newly described species of *Leucophyllum*, intact as to wording, from Dr. Flyr's unpublished doctoral thesis. To me it seems appropriate that one of the taxa in this genus bear his name. Commenting to me about *Leucophyllum* once, he said, "we are lovers". I liked that attitude and that's why I've wed them here.

Born: Lowell David Flyr, Stratford, Texas 24 Nov 1937
Parents: Bonnie Burns Almon Flyr and Lewis Anthony Flyr (deceased)
Education: Attended public schools in Cleburne and Denton, Texas
Graduated, Denton High School, 1956
B.A.—Southern Methodist University, 1960
Ph.D.—University of Texas, 1970

Honors: 1960—Phi Beta Kappa at SMU
1960—Recipient of the Avella Winn Hay award, as outstanding graduating male student
1960—Recipient, Research Award, Dallas Association of Phi Beta Kappa
1970—Research Fellow, Harvard University

Died: by his own hand, Woodlawn Hospital, Dallas, Texas 2 Nov 1971.
Buried: Stratford, Texas

Publications:

1966

Chromosome numbers in the Compositae. X. North American Species. Amer. J. Bot. 53:24-33 (with B. L. Turner).

1967

New names and records in *Brickellia* (Compositae). Sida 3:252-256.

1970

A systematic study of the tribe *Leucophylleae* (Scrophulariaceae). Doctoral Dissertation, The University of Texas, Austin.

1971

Thelesperma shinnersii Flyr (Compositae), a new species from Coahuila, Mexico. Sida 4:276-277.

Dyssodia tenuiloba (Compositae): New to Mississippi. Sida 5(2). In press.

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Guy Nesom

SIDA CONTRIBUTIONS TO BOTANY

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SIDA, founded by Lloyd H. Shinners, is privately published by Wm. F. Mahler, SMU Herbarium, Dallas, Texas, 75275, U.S.A. Subscription price $8 (U.S.) per volume; parts issued twice per year.

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SIDA Contributions to Botany, Volume 5 Number 2, pages 59—136
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SEX AND THE ANGIOSPERMS

JOHN W. THIERET
University of Southwestern Louisiana
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Discussed in this essay is the almost universal application of sexual terminology to sporophytic structures of angiosperms. Sex in plants was not well understood until the latter part of the 19th century. Prior to that time, the use of sexual terminology in botany was conjectural—and was not noted for unfailing accuracy. Its misuse then does not justify its misuse now. Sexuality in plants, as it applies to alternation of generations, is well understood today; sexual terminology should be restricted to plants and plant structures that are morphologically sexual.

The use—rather, misuse—of sexual terminology for sporophytic structures of angiosperms has long been rife with botanists. As a starting point for discussion, however, we might select the Linnaean "Sexual System," a product of fanciful analogy between vegetable and man[1] and of an era antedating factual knowledge of sex in plants. This system is now of historical interest only except for its attribution of sex to sporophytes, a concept to which, even in the enlightened 1970's, many botanists tenaciously cling.

Among the lower embryophytes—the bryophytes and pteridophytes—the use of terms indicative of sex is confined to the gametophytic phase. Thus, for example, we speak of a gametophyte as being male, female, or bisexual (hermaphroditic); we speak of an antheridium as being a male structure, of an archegonium as being a female structure. Among these plants, we do not apply sexual terms to the sporophytic phase.

Such restriction of sexual terminology to gametophytes is not the case, however, with the angiosperms. Not only is the gametophytic phase described with sexual terminology—e.g., the embryo sac is female—but, by an astonishing extension of meaning, so is the sporophytic phase. Among the sporophytic structures thus endowed with sex are flowers ("male," "female," "bisexual"), stamens ("male"), carpels ("female"), and even plants ("male" and "female"). The use of sexual terminology for sporophytic structures is, on occasion, even more ludicrous: in an otherwise eminently respectable journal I recently noted the terms "male sepal" and "male pedicel."[2]

Sexual terminology for sporophytic structures is not only misleading, inconsistent, and inaccurate but also superfluous, referring to precisely the same concepts as do the following terms, which are, it seems to me, above

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[1] We *all* know about the Swedish attitude toward sex.

[2] To extend this absurdity even further, why not "male" or "female" vessel elements or stomates. And one might wonder if, at the base of a plant that bears "male pedicels," one might find "male roots."

SIDA 5 (2): 59—60. 1973.

reproach: staminate ("male"), carpellate ("female"), imperfect ("unisexual"), and perfect ("bisexual").

By extension of the same reasoning (or lack of it) that permits the use of sexual terminology for flowers, the sporophytes of *Selaginella* and *Marsilea* could be called "bisexual" and the megasporangia and microsporangia of *Selaginella* could be called, respectively, "female" and "male."

The correct and consistent use of sexual terminology for angiosperms will lead to increased exactness in one minuscule part of our taxonomic vocabulary. Taxonomy may never be an exact science but this does not excuse taxonomists from striving diligently for terminological precision.

TAXONOMY OF *PERITYLE* SECTION *LAPHAMIA* (COMPOSITAE-HELENIEAE-PERITYLINAE[1]

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Section *Laphamia* comprises an assemblage of rock-dwelling species ranging from western Texas to southern California, throughout the southwestern United States, and northern Mexico. Thirty taxa are recognized, twenty-one species and nine varieties.

Laphamia was described originally as a genus by Gray (1852) who noted its resemblance to *Perityle*. Several other investigators have been concerned with the close relationship of traditional *Laphamia* and *Perityle*, and several interpretations regarding generic status have evolved from their morphologically oriented studies (Shinners, 1959). Most workers have agreed that the only semi-consistent difference between *Laphamia* and *Perityle* is the presence of well-developed pappus squamellae in the latter and an absence of pappus scales in the former. I have proposed elsewhere that *Laphamia* and *Perityle* are best treated as sections of a single genus, based upon the evaluation of information from cytological, chromatographical, and hybridization techniques (Powell, 1968a). A third section, sect. *Pappothrix*, is also recognized for *Perityle* (Powell, 1969).

The closest generic relatives of *Perityle* are believed to be *Pericome*, *Eutetras*, and *Amauria* of the subtribe Peritylinae. Presently the Peritylinae is being re-evaluated with reference to Rydberg's (1914) original concept of the phylad, and few other small genera with more distant relationship to *Perityle* probably will be added to the subtribe (Powell and Turner, unpublished). In fact, Peritylinae properly belongs with another tribe of Compositae, either Senecioneae or Heliantheae.

ACKNOWLEDGMENTS

I am deeply grateful to B. L. Turner for contributing in many respects toward the completion of this work. He originally directed my attention to the genus and has since provided invaluable systematic counsel. I am also grateful to students Sam Sikes and Dicke Patterson who have contributed much more than perfunctory technical assistance in the studies of *Perityle*. I wish to acknowledge gentleman-explorer Pave Smith of Taft, California, for facilitating the collection of *P. inyoensis*. I am further indebted to the late Lloyd H. Shinners for providing the Latin diagnoses included herein; to John Averett and Tom Watson for collecting bud material of *P. stansburii* and *P. megalocephala*; and to Tom Todsen and Rich Spellenberg for providing new information about *P. staurophylla*.

[1] Supported by NSF Grants GB-2400, GB-5046, and GB-7740.

My special appreciation is extended to the patient curators of herbaria from which specimens were borrowed.

CHROMOSOMAL CONSIDERATIONS

Chromosome numbers are available for 19 species of sect. *Laphamia* ($x=17$). Counts for most taxa have been recorded elsewhere (Powell, 1968b; Powell and Sikes, 1970). Chromosome numbers for *P. stansburii* ($n=17$), *P. gracilis* ($n=34$), *P. megalocephala* var. *oligophylla* ($n=34$), and *P. megalocephala* var. *intricata* ($n=19\pm1$) were not previously reported (Table 1). It has not been possible to obtain accurate counts for *P. villosa* and *P. coahuilensis*. *Perityle grandifolia* and *P. gentryi* have not been counted.

TABLE 1. Species of *Perityle* sect. *Laphamia* examined for chromosome number.

Species	*n* Number	Location and Voucher
P. gracilis	34	NEVADA: Lincoln Co. ½ mi N of Caliente. *Powell and Patterson 1626.*
P. gilensis var. *salensis*	ca. 17[a]	ARIZONA: Gila Co. Salt River Canyon. *S. Sikes 428.*
P. megalocephala var. *intricata*	ca. 19[b]	NEVADA: Nye Co. 23 mi W of Indian Springs. *Watson and Averett 250.*
P. megalocephala var. *oligophylla*	34	CALIF: Inyo Co. Lost Burro Gap, Cottonwood Mts. *Powell and Patterson 1612.*
P. stansburii	17	UTAH: Beaver Co. 1:5 mi E of Minersville, *Averett and Watson 422.*
P. stansburii	ca. 17[c]	UTAH: Tooele Co. 1.6 mi NE of Low, *Watson 332.*

[a] Round fragment or univalent observed in some cells.
[b] Actually recorded as n = 19 II ± 1.
[c] In most cells observed 17 II + 2 I; in few cells also observed 17 II, 16 II + 2 I, 17 II + 4 I, and ca. 18 II.

The base chromosome number of sect. *Laphamia* is established as $x=17$. All but three species are on the base of $x=17$. *Perityle inyoensis* has been counted as a "questionable" $n=18$, and *P. tenella* and *P. congesta* are $n=16$ (Powell, 1968b). The var. *intricata* (Table 1) is reported above to be $n=19\pm1$, and may be a fourth exception to the $x=17$ base, but its meiotic configurations were observed to be abnormal (17-20 II and 2-7 I).

Regular meiosis was observed to be characteristic of polyploid populations (Powell, 1968b), with but a few exceptions. Meiosis in three individual plants from one population of *P. megalocephala* var. *oligophylla* ($n=34$) showed 1-3 multivalents (rings or chains of 3-4) and 2-4 associated but asynaptic univalents. One to five lagging univalents were common at anaphase I. No exact chromosome number was discernable in one population (*Averett 418*) of *P. stansburii* ($x=17$), but meiotic behavior resembled that of a triploid. Approximately 20 II and 6-12 I were commonly observed. *Perityle coahui-*

lensis tentatively was determined to be $n=27$-34 II, with irregular multivalent and univalent behavior preventing an accurate count. Triploid meiotic behavior also was observed in *P. villosa* (tentatively $n=$ca. 17 II and 17 I). Meiosis was observed in plants from one population, and in a single plant from the same collection which was grown in the greenhouse. The number of apparent univalents varied from 3-19, the latter often being difficult to distinguish from bivalents because of bivalent heteromorphism. It is assumed that the plants of *P. villosa* examined are recent triploids.

No direct evidence is available on the precise origin of polyploid populations in sect. *Laphamia*. Autoploid origin has been assumed as a working hypothesis in most cases because polyploids generally are morphological reflections of diploids. Also to be considered is the fact that meiosis is normal in a large majority of the known polyploid populations. Certainly no reliable morphological or cytological evidence of alloploid genome constitution has been detected in any polyploid taxon of sect. *Laphamia*, with the possible exception of *P. coahuilensis*. This subject is under experimental study.

CHROMATOGRAPHIC CONSIDERATIONS

Simple pattern data from 2-dimensional paper chromatograms have been utilized in studying relationships among species and species groups of sect. *Laphamia*. The current investigations have corroborated preliminary studies which showed that most species of sect. *Laphamia* produce species-specific patterns (Powell and Tsang, 1966), although closely related taxa characteristically produce patterns which are much alike. General techniques have followed those outlined by Alston and Turner (1963), except that pure methyl alcohol was employed as an extracting solvent. Observations were made under ultra-violent light, with and without the presence of ammonia vapor. The major components have been identified as flavonoids (Powell and Averett, unpublished). Specific identity of several compounds is under study.

It is deemed beyond the scope of this paper to present detailed chromatographic data in the form of figures or tables, even where such evidence has been helpful in understanding putative relationships. Instead, where appropriate, conclusions drawn from comparative pattern data are presented in discussions. It might be argued that the explanations of "Chromatographic Considerations" should be omitted from this work since the specific data upon which they are based have not been included. However, use of the "pattern character" as a monographic tool is relatively innovative, and it is important that the taxonomic basis of its application be understood. It is strongly believed that simple chromatographic pattern data are best treated as merely another taxonomic character, and appraised as such in toto along with all other sources of information.

Chromatograms of leaf extracts have been developed for 19 of the 21 species recognized for sect. *Laphamia*. No recent collections of *P. grandifolia* or *P. gentryi* have been available. For each species, chromatograms

were produced from one to several individual plants and/or populations, depending upon the availability of fresh material. Considerable precautions were taken to ensure consistency in technique, and thus pattern variability is believed to represent primarily that which is intrinsic for each taxon.

For the most part, systematic relationships inferred from chromatographic information have corresponded with affinities judged from morphological, chromosomal, and other data. Pattern analyses of taxa comprising related-species groups have been most useful. For example, seven geographically proximal species of the southwestern United States have been assumed to represent a monophyletic group on the basis of their similar morphologies. Five of these species appear to be the most closely related and have chromosome numbers of $x=17$ ($n=$ca. 18 in *P. inyoensis*). A base number of $x=16$ for the two remaining species (*P. congesta* and *P. tenella*), however, suggests the possibility of other kinship. Chromatographic analysis of all seven species has revealed a chemical profile which sets them apart from the rest of the sect. *Laphamia*. Furthermore, the chromatographic pattern character of each species of this "southwestern alliance" corresponds exactly to presumed interspecific relationships which have been arrived at through morphological studies. Other morphologically founded species groups, such as *P. lemmoni, P. dissecta, P. castillonii*—, *P. lindheimeri, P. angustifolia*—, and *P. bisetosa, P. warnockii*, also have been found to exhibit chemical integrity.

The total chemical data gathered to date, especially the crude pattern data, are not yet sufficient to allow sweeping conclusions as to infrasectional and intersectional phylogeny within *Perityle*.

HYBRIDIZATION CONSIDERATIONS

Natural hybridization does not appear to have been an important factor in the evolution of sect. *Laphamia*. Perhaps this is simply because none of the species of this section are known to occur sympatrically. Nevertheless, artificial interspecific hybrids between numerous species have been obtained readily in the greenhouse, and thus there seems to be a general absence of strong genetic barriers to interspecific hybridization within the section (Powell, unpublished).

Artificial hybrids between several species belonging to different sections of *Perityle* also have been produced in the greenhouse, and in some cases with rather amazing ease. Examples of experimental intersectional hybrids include the following combinations: *P. bisetosa* X *P. rupestris* (sect. *Pappothrix*); *P. castillonii* X *P. vaseyi* (sect. *Perityle*); *P. quinqueflora* (sect. *Pappothrix*) X *P. vaseyi*. Numerous other successful intersectional combinations could be cited. A few species belonging to separate sections of *Perityle* are known to have sympatric distributions. In the Chisos Mts. of Texas, natural intersectional hybridization involving *P. rupestris* var. *albiflora* (sect. *Pappothrix*) and *P. parryi* (sect. *Perityle*) has been detected, and this phenomenon now has been documented (Powell, 1970).

Surprisingly enough, artificial intergeneric crosses also have been successful. Examples include *Eutetras palmeri* X *P. cernua* (sect. *Pappothrix*), *E. palmeri* X *P. jaliscana* (sect. *Perityle*), *E. palmeri* X *P. parryi* (sect. *Perityle*), and *Pericome caudata* X *Perityle saxicola.*

Evidence oriented toward utilization of hybridization data in evaluating systematic relationships among the species of sect. *Laphamia* still is being accumulated. Experimentally, at least, closely related species of this section are so interfertile that several generations may be required in order to judge degrees of genetic affinity on this basis.

Information about the general interfertility of species in *Perityle* has given reason to suspect the possibility of hybrid origin for several taxa of sect. *Laphamia* which have nebulous systematic affinities. Somewhat intermediate morphology, or other classical manifestations of possible hybrid involvement, has been detected in *P. staurophylla, P. coahuilensis, P. cochisensis, P. villosa,* and a population of *P. lemmoni.* Since all species of this section are mutually isolated geographically, it would appear that the mere breakdown of spatial barriers would be sufficient to allow hybridization. However, in all of the above suspected cases of hybridization, evidence of recent populational confluence between putative parents is lacking. As a matter of fact, evolution of the peculiar rock-bluff habitats theoretically represents a rather permanent deterrent to secondary sympatry, at least with regard to "recent" time connotations. As mentioned earlier, a few species belonging to different taxonomic sections are known to occur sympatrically, but natural hybridization has been detected in only one instance. This suggests that reproductive barriers between taxa of separate sections do exist under natural conditions even though hybrids can be synthesized in culture. Markedly low fertility is known to be characteristic for most artificial F_1 intersectional hybrids (Powell, unpublished). Still, the *P. rupestris* X *P. parryi* intersectional hybrid points to what could have happened in the course of *Perityle* evolution. It is evident that the possibility of rather "ancient" hybridization within the genus should not be overlooked in future systematic studies of the Peritylinae.

MORPHOLOGICAL CONSIDERATIONS

Numerous morphological features are useful in circumscribing taxa and evaluating systematic relationships among species of sect. *Laphamia.* Most notably these include habit, pubescence, leaf shape and size, capitulescence, head size and number of florets, flower color, presence or absence of ray florets, and achene-pappus morphology.

The habits of most species are influenced to a large extent by their rock-bluff habitats. Plants may be erect, pendulous, or closely appressed to rocks, depending at least partially upon the angle of bluff exposures. Bluffs which are nearly perpendicular usually support plants which are somewhat pendulous, unless the stems are very short as in *P. bisetosa,* while in nearly horizontal exposures plants tend to become semi-erect or spreading. Both

extremes in habit often are exhibited by a single species. The height (or length) of plants varies tremendously, from approximately 2 cm in *P. bisetosa* to about 50-60 cm in several species such as *P. lindheimeri*. Wide infraspecific variation in plant height is not uncommon. Unquestionably, sun exposure has an affect on plant size when exposure is a variable factor in a particular habitat. As would be expected, plants exposed to full sun for several hours per day characteristically are more diminutive than those which grow under relatively shaded conditions. Older plants of some species like *P. staurophylla* and *P. megalocephala* tend to become profusely branched and spread to widths approaching one meter, while in other species such as *P. warnockii*, plants have not been observed to exceed a diameter of approximately 10 cm. The strong suffruticose or suffrutescent perennial condition exhibited by all species is judged to be an ancestral trait in *Perityle*. The only annual taxa of the genus are members of sect. *Perityle*.

Pubescence appears to be significant in only a few species. Taxa such as *P. bisetosa*, *P. staurophylla*, and *P. coahuilensis* are essentially glabrous, while *P. villosa*, *P. inyoensis*, *P. dissecta*, and *P. gentryi* are characterized by pilose-villous pubescence. Most species are variably short-pubescent and the indument does not appear to be important taxonomically.

Leaf shape and size are extremely variable among the species of sect. *Laphamia*. Even infraspecific variation is considerable in some taxa, but leaf morphology generally is the most important taxonomic character in this section. The smallest leaves are found in *P. bisetosa* (ca. 0.5-1.0 cm long) while *P. grandifolia* produces the largest leaves (8-11 cm long). The latter species, along with a few others, have essentially ovate leaves with entire to serrate or shallow-lobed margins. Leaf variability in sect. *Laphamia* is expressed to its greatest extent in the degree of margin dissection. The specific epithet of *P. dissecta* is particularly descriptive of one extreme condition where margins are irregularly cleft and divided. *Perityle saxicola* has leaves which are bi- to tripinnate with long, narrow segments. There is a strong tendency toward tripartitioning of leaves in taxa of this section, as evidenced especially by *P. staurophylla*, *P. gilensis*, *P. gracilis*, and *P. coahuilensis*. In fact, 17 of the 21 species display tripartite leaves to some extent, from shallow to deeply lobed.

The capitulescence of most species is of solitary heads on short or long peduncles, depending upon the taxon being considered. In several taxa, however, as in *P. angustifolia* and *P. megalocephala* var. *oligophylla*, the heads are arranged in loose clusters of two to four. The capitulescences of *P. lindheimeri*, *P. staurophylla*, and *P. megalocephala* var. *intricata* are of rather tightly clustered small heads (corymbiform), and are unique in sect. *Laphamia* with regard to this character. The corymbiform condition probably is primitive in *P. lindheimeri* and *P. staurophylla*, but the feature appears to be derived in *P. megalocephala* var. *intricata*.

As might be assumed, head size varies rather consistently in correlation with the number of florets per head. Smallest heads are found in the Texas

species, *P. bisetosa*, *P. warnockii*, and *P. lindheimeri* (ca. 9-12 florets) and the largest heads are produced in the Arizona species *P. saxicola* and *P. gilensis* (ca. 100-200 florets). Most species have about 25-70 florets per head.

The species of sect. *Laphamia* have yellow flowers, with the exception of *P. bisetosa* and *P. warnockii* which have white flowers. In four of the yellow-flowered taxa, *P. dissecta*, *P. castillonii*, *P. lemmoni*, and *P. coahuilensis*, the disc corollas tend to become purple tinged at maturity. Flower color has limited infrasectional taxonomic importance simply because so few species differ in this trait. However, it does appear that ray and disc floret coloration will contribute significantly toward evaluating intersectional and intergeneric phylogenies within the subtribe Peritylinae. Preliminary hybridization studies have borne out the latter contention (Powell, unpublished).

Normally, radiate heads characterize only seven species of this section: *P. grandifolia*, *P. gentryi*, *P. stansburii*, *P. lindheimeri*, *P. saxicola*, *P. gilensis*, and *P. staurophylla*. A few specimens from an atypical population of *P. lemmoni* have ray florets, but this species otherwise is entirely discoid. Also, a single ray floret was formed in one head and two in another head of a plant of *P. coahuilensis* which was grown in the greenhouse. All field collections of the latter taxon are discoid. The ligules are yellow in all species.

Achene and pappus morphology are considered to be among the most important taxonomic features in sect. *Laphamia*. Generally speaking, species of the section are characterized by an absence of prominent pappus squamellae and by short-pubescent margins of flattened achenes, although these features are not absolute with regard to intersectional delimitation (Powell, 1968a). Achene structure per se is somewhat less valuable at the interspecific level than is the more variable pappus structure. In sect. *Laphamia* (and sect. *Perityle*), the pappus may be comprised of two parts, bristles and squamellae. Bristles are produced characteristically in 15 species, while in five species bristles are absent (or only rarely found). In taxa which usually have bristles, the actual number on each achene may vary from 0-2 (3-6). In fact, population studies have shown that variability in bristle number is typical of most species. For example, *P. castillonii* is characterized by achenes with 1-2 bristles, but some plants produce achenes with 3 bristles, and some populations are epappose. In one population of *P. staurophylla*, achenes usually are bisetose, but many plants were observed to have achenes with 3-6 bristles. Bristle number does appear constant in a few species, however, such as the wide-ranging *P. stansburii* in which only unisetose achenes have been observed. Judging from all correlated evidence, and with some reliance on the axiom that plant parts are more easily lost than gained, the presence of bristle(s) is thought to be an ancestral trait in sect. *Laphamia*. Certainly, the epappose species seem to have been derived from pappose ancestors, with the possible exception of *P. grandifolia*. Best examples of the latter contention are expressed by the epappose

species *P. angustifolia* and *P. megalocephala*, which clearly seem to have been derived from *P. lindheimeri* and *P. stansburii* respectively.

A crown of rather inconspicuous, hyaline squamellae, usually supported by a thin, callous crown, occurs as part of the pappus in some species of sect. *Laphamia*. In sect. *Perityle*, achenes of nearly every species have relatively prominent crowns of squamellae. *Laphamia* and *Perityle* have been separated as genera primarily on the basis of this character (Shinners, 1959; Powell, 1968a). There is no certainty that the crowns of squamellae in each section are homologous structures, but it seems most logical that those in sect. *Laphamia* represent reduced or vestigial forms derived from the prominent scales of sect. *Perityle* species. Careful examination has not revealed any morphological difference, other than size, between the reduced squamellae of sect. *Laphamia* and the prominent crown in sect. *Perityle*. It should be emphasized that even vestigial pappus squamellae are not evident in all species of sect. *Laphamia*. Also, the small scales may be absent in some populations, individual plants, or even in some heads of species which normally exhibit squamellae. A thin callous crown remains on the achenes of plants in which no squamellae are found, and possibly should be regarded as the ultimate in reduction of a pappus crown.

PHYLOGENETIC CONSIDERATIONS

No clear picture regarding the evolutionary history of sect. *Laphamia* can be presented at this time. Partly this is because intersectional relationships within *Perityle* still require further study, but also because there is some indication that sect. *Laphamia*, as treated here, actually is a polyphyletic assemblage. It appears significant, however, to explore some of the most reasonable conclusions which can be drawn on the basis of present knowledge about the section.

Currently, it seems logical to assume that sect. *Laphamia*, at least in part, had its origin from sect. *Perityle*. Certainly the close relationship of the two taxa is reflected in their overall morphological similarity. That sect. *Laphamia* was derived from sect. *Perityle*, instead of the other way around, is suggested by the several characters of sect. *Laphamia* which appear reduced from pre-existing structures in species of sect. *Perityle*. The most consistent of these reduced characters are the vestigial (or absent) pappus squamellae and short-pubescent achene margins, but other such features are revealed in succeeding discussions.

All but two species of sect. *Laphamia* have yellow flowers. *Perityle bisetosa* and *P. warnockii* have white flowers. The predominance of yellow-flowered species, along with other information, supports an assumption that the section had yellow-flowered ancestry, although this apparently does not apply to *P. bisetosa* and *P. warnockii* which may have originated from a white-flowered member of sect. *Pappothrix*. Ray florets normally are produced in only seven species of sect. *Laphamia*. The ligules are yellow in all seven species, again suggesting that the section, at least in part, had its

origin from a yellow-flowered ancestor. Since sect. *Laphamia* presumably arose from sect. *Perityle*, ray coloration in that section might be expected to provide an important phylogenetic clue. All but three of the 24 species currently proposed for sect. *Perityle* (Powell, unpublished) have radiate heads. The ligules of 13 species are white, and nine taxa have yellow ligules. Among the nine species with yellow ray florets, all but four taxa can be eliminated as likely ancestors on other grounds (such as annual habit), thus considerably narrowing the search for a phylogenetic antecedent of sect. *Laphamia*. The remaining four taxa are *P. palmeri*, *P. leptoglossa*, and *P. cordifolia* which are found near the foothills of the Sierra Madre Occidental in northwest Mexico, and *P. parryi* which is distributed along the Rio Grande of West Texas. There is no attempt to place undue emphasis on the presence or absence of ray florets and flower coloration in evaluating the systematics of sect. *Laphamia*. It is expected that further studies, particularly of sect. *Perityle*, will result in an accumulation of additional evidence upon which to evaluate the above phylogeny.

Species of sect. *Laphamia* are distributed entirely in various mountain or rock formations at altitudes ranging from ca. 8500 ft. to ca. 3000 ft. Plants grow only in crevices of bluffs or boulders, or almost any type of exposed rock formation of considerable mass and stability. Occasionally a few plants of some species (e.g., *P. gilensis* and *P. megalocephala*) have appeared to be growing in soil at the base of bluffs, but further examination always has shown them to be rooted in subterranean crevices. As stated earlier, as far as is known, all species of sect. *Laphamia* are allopatric in distribution.

Listed in Table II are characters which I consider to be primitive and advanced in sect. *Laphamia*. In attempting to evaluate such features, reference to similar studies in the Heleniceae by Carlquist (1956), Ellison (1964), Ornduff (1966), and in the family Compositae by Cronquist (1955), have been most helpful. No effort has been made to concoct a hypothetical "primitive species" for the section because of the likelihood that the taxon is polyphyletic. Suspected primitive species are brought out in subsequent discussions.

The center of origin for Peritylinae probably was in the Sierra Madre Occidental of northwestern Mexico, and the evolution of its constituent taxa probably had some correlation with the proliferation of the Madro-Tertiary Geoflora (Axelrod, 1958). The Mexican distribution of *Eutetras* and *Pericome*, genera considered to be ancestral to *Perityle*, and the distribution of supposedly primitive species of *Perityle* itself, appear to be supportive of the above genesis (Powell, unpublished).

Presently, the native species of *Perityle* are fairly widely distributed in western North America, from Jalisco, Mexico, to central Texas, northwestern Utah, and Baja California, Mexico (Fig. 1). A South American disjunct of the genus, *P. emoryi* (*Closia* Remy), occurs in Chile. Raven (1963) cited *P. emoryi* as one example in contending that most of the disjuncts between North and South America may have attained their distri-

TABLE II. Primitive and Advanced Characters in Sect. *Laphamia*

Primitive Character	Advanced Character
1. Plants relatively mesophytic	Plants xerophytic
2. Leaves serrate or shallow-lobed	Leaves lobed, cleft, or divided
3. Herbage pubescent	Herbage puberulent or glabrous
4. Phyllaries numerous	Phyllaries few
5. Ray florets present (yellow)	Ray florets absent
6. Disk florets numerous	Disk florets few
7. Achenes slightly rounded or angular in cross section	Achenes strongly flattened
8. Achenes pubescent	Achenes glabrous
9. Pappus or bristles and vestigial squamellae	Pappus reduced, especially squamellae
10. Achenes pappose	Achenes epappose
11. Chromosome number $n=17$ (18)	Chromosome number below $n=17$ or higher by polyploidy

bution during the late Pliocene or Pleistocene. Since *P. emoryi* is considered to be a derived species of *Perityle*, one could assume that evolutionary divergence of the genus might have been underway before or during the Pliocene. It also follows that the relatively widespread dispersal of *Perityle* might not have occurred until late Pliocene or Pleistocene, because as Sharp (1953) and Dressler (1954) have suggested, the most propitious time for migration of temperate plants was during the Pleistocene. Evidence presented by DeJong (1965) in favor of Pleistocene dispersal and evolution of *Astranthium* (Astereae) parallels other reasons for suspecting similar evolution in sect. *Laphamia*. These reasons are that (1) nearly all of the species are endemics, (2) related species occupy adjacent ranges, and (3) "most species share genic material, as indicated by artificial crosses, suggesting recent evolution."

Judging from present day distribution, it is possible to assume that sect. *Laphamia* diverged early from its presumed ancestral stock in sect. *Perityle* (Fig. 1). The northern distribution limits of *Perityle*, in northwestern Utah, are occupied by species of sect. *Laphamia*. Species of sect. *Perityle* are not known to extend past central Arizona (e.g., *P. ciliata*), and these species of sect. *Perityle* are not the most closely related to sect. *Laphamia*. Furthermore, most species of sect. *Laphamia* are distributed in drier mountain regions to the north and east of their supposed ancestral birthplace in the more mesic mountains of northwestern Mexico. The bulk of the species of sect. *Perityle* still reside in the mountains of Mexico. Because of the apparent "close" relationship between sect. *Laphamia* and sect. *Perityle*, early divergence of the two phylads is not easy to reconcile, unless sect. *Laphamia* experienced relatively rapid evolution. It does seem likely that rapid evolution of sect. *Laphamia* would have been possible under Pleistocene climatic conditions, especially if its genome manifested some special

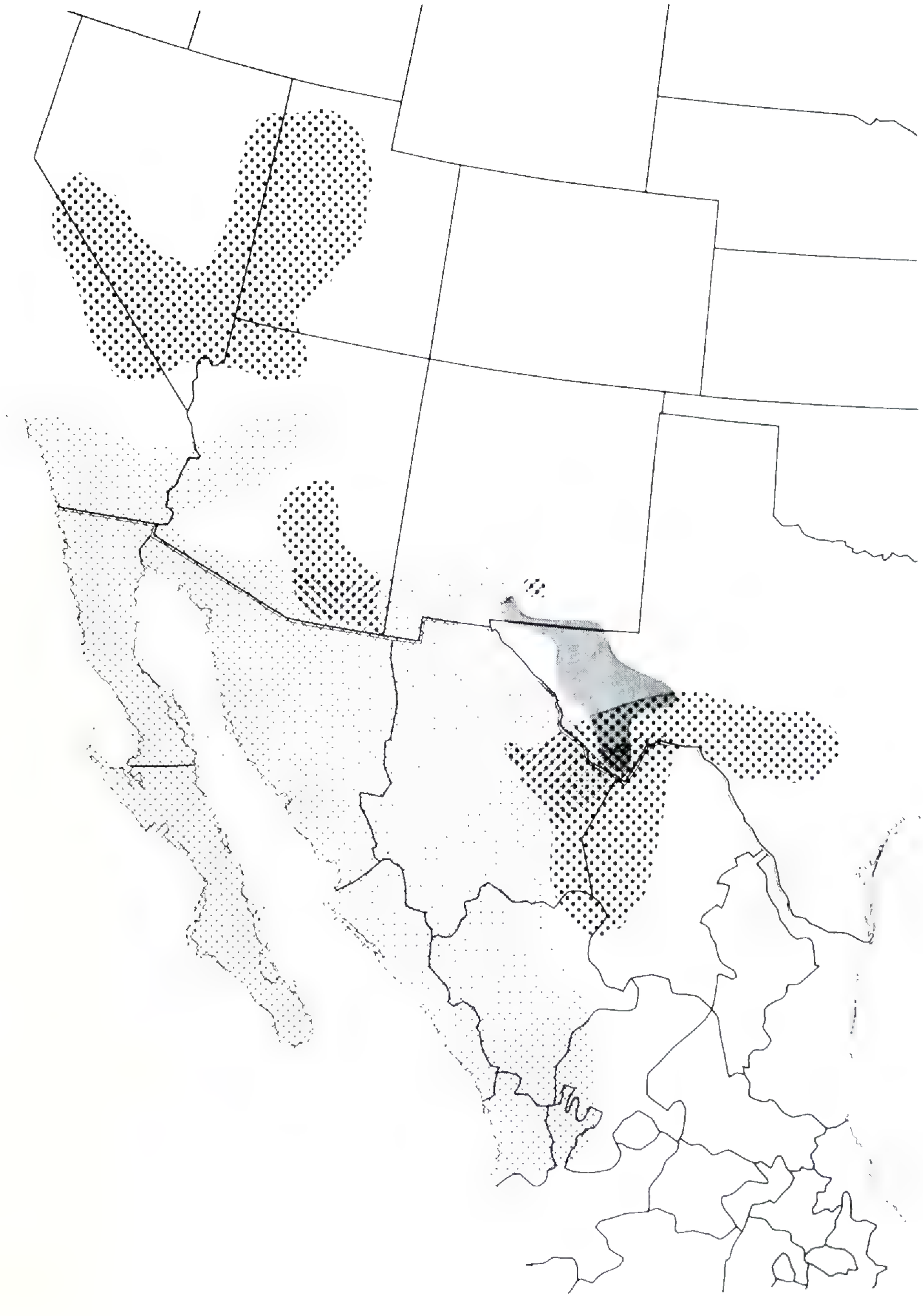

Fig. 1. Distribution of the genus *Perityle*: sect. *Pappothrix* (shaded); sect. *Laphamia* (dotted); sect. *Perityle* (crosshatched).

tendency for adaptation to drier environments.

To some extent the biological evolution of *Perityle* species must have been correlated with *post annis* geological evolution of mountain systems through-

out the southwestern United States and northern Mexico. To attempt critical evaluation of species-mountain evolution at this time seems prohibitive because of the tremendous area to be studied, but some general observations concerning the subject seem pertinent.

Many species now comprising sect. *Laphamia* might have emerged from a wide-ranging ancestral taxon which had populational segments become geographically isolated by "ancient" erosion, or the phylad might have originated from a gradual expansion of pioneer populations into available habitats. Quite naturally, the latter statement represents an ambivalent quandary which has become an overriding problem in understanding phylogeny within *Perityle*. Regardless of the actual beginning of sect. *Laphamia*, the successful evolution of many species must have been associated positively with the geological evolution of new habitats, i.e., the formation of exposed rock bluffs. Essentially the same conditions were explained by Raven (1964) to have had a general influence on the evolution of plant species in the desert southwest where the encroachment of relatively xeric environments upon relatively mesic environments (and subsequent edaphic factors) provided marginal populations an opportunity for "catastrophic selection." When considering two or more related species of sect. *Laphamia*, often it is difficult to determine which actually occupies the driest habitat, but as a general rule it appears that derived species are associated with the most xeric environment. In discussing catastrophic selection with regard to closely rated pairs of species in *Clarkia* (Onagraceae), Lewis (1962) found that the derivitive species invariably occupy more xeric habitats than their progenitors. This also seems to be the case in sect. *Laphamia* where closely related pairs of species are common. Although the restricting rock-bluff habitat of sect. *Laphamia* species necessitates a somewhat modified interpretation of catastrophic selection and mesic to xeric adaptation, Raven's and Lewis' concepts appear to be particularly relevant to understanding evolution in the section.

The restricted habitat of the species of sect. *Laphamia* is thought to be an extremely important consideration in understanding speciation in the phylad. Several groups of related species (and varieties) offer evidence that geographic isolation is a primary "mechanism" for speciation in sect. *Laphamia*. Beaman (1957) pointed out the importance of this type of spatial isolation in the infrageneric evolution of *Townsendia* (Astereae). Among the taxa which appear to exemplify this phenomenon in sect. *Laphamia* are the clearly related *P. lindheimeri* and *P. angustifolia*, which occur in west-central Texas. *Perityle lindheimeri* occupies rather protected, moist limestone canyons in heavily vegetated areas of the Edwards Plateau. *Perityle angustifolia* is found in drier, more eroded and exposed caprock areas along the western edge of the Edwards Plateau. Morphologically, it appears that *P. angustifolia* evolved from *P. lindheimeri* as the former became isolated and adapted to drier habitats. *Perityle bisetosa* and *P. warnockii*, also found in dry areas of western Texas, provide another example of speciation fol-

lowing geographic isolation. These species are clearly related morphologically, and occupy disjunct but similar limestone habitats. Four varieties of *P. bisetosa* have been recognized. All of the infraspecific taxa are distinctly isolated in severely eroded, small-mountain areas. One needs merely to examine the localities of other Laphamian taxa to find additional instances where speciation apparently occurred subsequent to geographical isolation.

It is quite possible that polyploidy has played an initial role in speciation of some Laphamian taxa. Several isolated species and infraspecific populations are polyploids (Powell, 1968b; Chromosomal Considerations), but in each particular case it is difficult to determine if an increase in ploidy level was an initial or subsequent isolation barrier. In fact, polyploidy is such a widespread phenomenon in the whole genus, that, more than likely, both sequencies of events have occurred. It is evident from previous compilations of chromosome numbers that additional cytological studies will contribute significantly to future systematic investigations in *Perityle*.

There are five related-species groups which can be recognized in sect. *Laphamia*. The largest of these supposedly natural assemblages of taxa is comprised of seven southwestern species, distributed from California to northwestern Utah and northwestern Arizona. For easy reference this group has been designated as the "southwestern alliance," and it includes *P. villosa*, *P. inyoensis*, *P. megalocephala*, *P. stansburii*, *P. gracilis*, *P. tenella*, and *P. congesta*. The four other related-species groups are: *P. lemmoni*, *P. dissecta*, *P. castillonii*—; *P. saxicola*, *P. gilensis*—; *P. lindheimeri*, *P. angustifolia*—; and *P. bisetosa*, *P. warnockii*. The proper infrasectional disposition of five rather anomalous species, *P. staurophylla*, *P. cochisensis*, *P. coahuilensis*, *P. grandifolia*, and *P. gentryi*, remains to be elucidated.

A tentative phylogenetic scheme for sect. *Laphamia*, based primarily on morphological, chromosomal, and chromatographical data, is presented in Fig. 2. This graphic method of presentation is adopted in preference to lengthy discussions which would have limited significance because of their conjectural nature. Some discussion, however, with regard to what are judged to be the most likely alternatives for the phylogeny of species and species groups in the section, would appear to be informative.

The exact infrasectional relationships of the related-species groups have remained obscure. As stated earlier, perhaps the complexity of these interrelationships partly is a reflection of the polyphyleticism which is suspected to have been involved in the origin of species which are recognized to comprise sect. *Laphamia*. For example, it seems likely that most members of the section owe their origin to sect. *Perityle*, but good evidence suggests that *P. bisetosa-P. warnockii* were derived from a white-flowered member of sect. *Pappothrix*. In sect. *Laphamia*, these species are anomalous with regard to their flower color. Furthermore, there are morphological and ecological indications of a connection between *P. bisetosa* and *P. vitreomontana* of sect. *Pappothrix* (Powell, 1969).

Considering all available evidence, the other related-species groups ap-

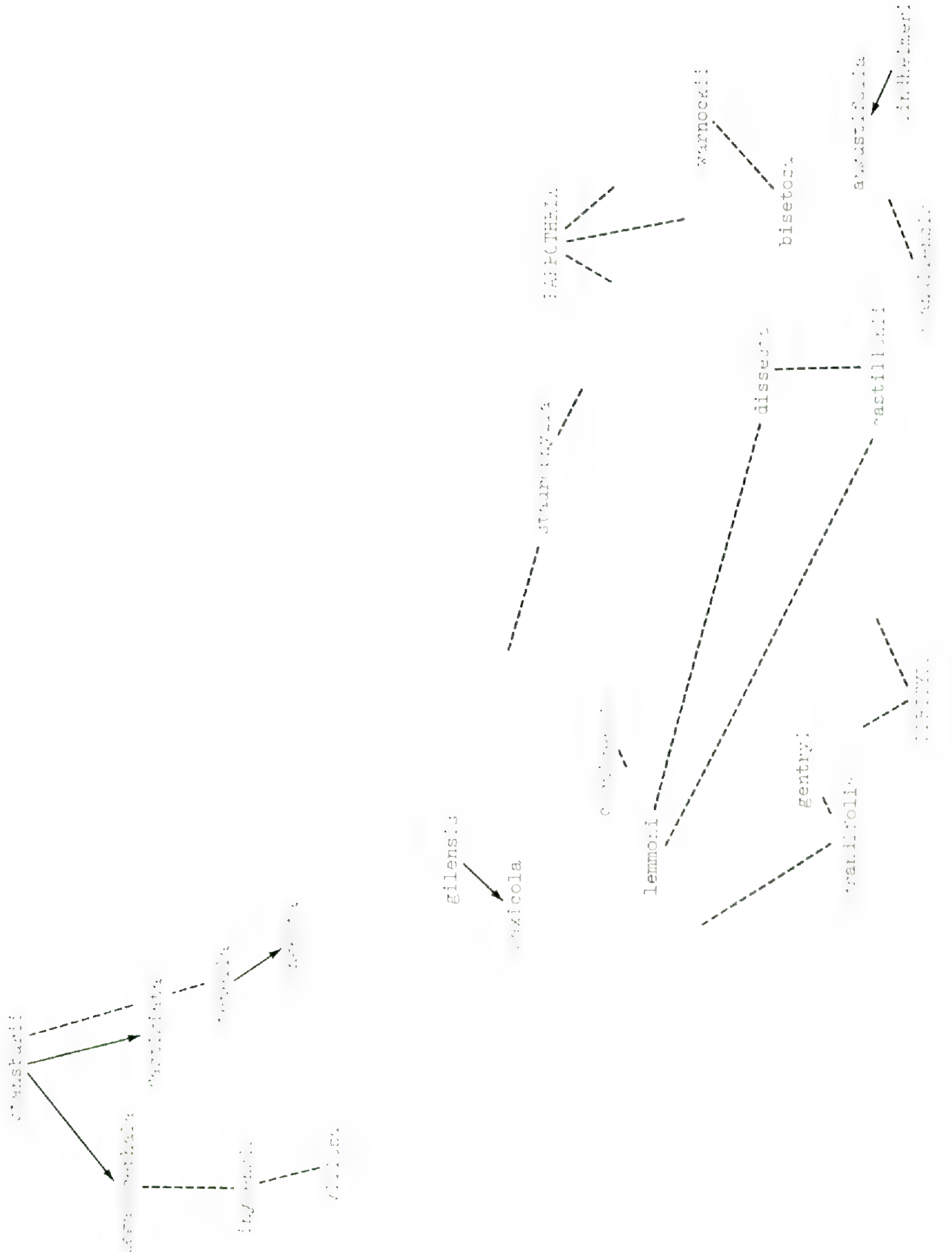

Fig. 2. Supposed evolutionary relationships among the species of *Perityle* sect. *Laphamia*, based upon all available data. The arrangement of species names approximates their geographic juxtapositioning. Solid lines indicate the most certain relationships and directions of evolution. Broken lines indicate probable affinities, but not necessarily phylogenetic sequence. The shorter (incomplete) broken lines depict possible or suspected relationships.

pear to have some real affinity with sect. *Perityle*, although, with the exception of the southwestern alliance and *P. saxicola-P. gilensis*, the evidence for this relationship is not at all satisfactory. The achene and pappus morphology of *P. lemmoni-P. dissecta-P. castillonii* and *P. lindheimeri-P. angustifolia* is typically Laphamioid, but their habits are sufficiently different from other Laphamias (and *Perityle*) that one must consider the possibility of other kinship. For example, the habit of the yellow-flowered *P. castillonii* bears a very striking resemblance to the yellow-flowered *P. rupestris* of sect. *Pappothrix*. If *P. bisetosa-P. warnockii* were derived from sect. *Pappothrix*, then it is logical that yellow-flowered taxa also could have emanated from sect. *Pappothrix*. The *P. castillonii* group exists under similar environmental conditions as do *P. bisetosa-P. warnockii*, and the geographic juxtaposition of both groups to sect. *Pappothrix* is the same (Fig. 2).

With the possible exception of *P. staurophylla* and *P. coahuilensis*, there are no species of *Perityle* which have apparent relationship with *P. lindheimeri-P. angustifolia*, and it should be remembered that the infrasectional position of the former two species themselves is not understood. Since *P. lindheimeri* is distributed in relatively old and stable Cretaceous limestone exposures at the extreme eastern periphery of the *Perityle* range (Fig. 2), it is conceivable that the taxon represents a very early offshoot from the ancestral stock of sect. *Laphamia*. By most standards in *Perityle*, however, *P. lindheimeri* would not be considered a primitive taxon largely because its plants have subcorymbiform capitulescences with small heads, few florets, and short rays. The latter characters are found in the genus *Pericome* (*P. caudata* is discoid), but not in any of the species of *Perityle* which are being considered as likely precursors of sect. *Laphamia*. Thus the possibility that *Pericome* has contributed to the seemingly polyphyletic nature of sect. *Laphamia* cannot be overlooked in the course of future studies.

Among the related-species groups of sect. *Laphamia, P. stansburii* of the southwestern alliance and *P. saxicola-P. gilensis* compare most closely with the yellow-flowered species of sect. *Perityle*, at least in terms of general vegetative and floral morphology. The species groups themselves, however, do not appear to be closely related. It has been difficult to determine whether or not these species groups constitute a direct link between sect. *Laphamia* and sect. *Perityle*. Perhaps both of them do. The radiate heads of *P. saxicola-P. gilensis* are the largest of any species in the section, and in this character especially they approach the supposedly ancestral species of sect. *Perityle*. Unfortunately, other features including their complex-lobed to pinnatifid leaves fail to support any close affinity with the pertinent species of sect. *Perityle*. It is tempting to speculate that *P. saxicola-P. gilensis* represent modified relects of ancestral Laphamian stock which migrated from the mountains of northwestern Mexico into northern Utah-Nevada and gave rise to the southwestern alliance.

Perityle stansburii actually is no more revealing with regard to the intersectional affinity of sect. *Laphamia* than are *P. saxicola-P. gilensis*. Never-

theless, the radiate heads, habit, and distribution of *P. stansburii* (Fig. 2) all suggest the possibility that it had early divergence as ancestral Laphamian stock, probably from sect. *Perityle*.

Further discussion of the southwestern alliance seems to be in order, since it comprises a sizeable number of taxa, as compared with the other related-species groups of the section. Like most species of *Perityle*, these taxa evidently have evolved through geographic displacement and subsequent genetic differentiation.

When one examines all the species of the southwestern alliance, it appears that *P. stansburii* fills the most expectations of an ancestral taxon. *Perityle stansburii* is the only species of the alliance which has both radiate heads and pappus of a bristle. Also, the latter species is the most widely distributed, and has a chromosome number of $x=17$. Other floral and vegetative features (including habit) of *P. stansburii* conform to an expected prototype of the southwestern alliance. None of the other species of this alliance produce ray florets. Pappus bristles (1-2), however, are found in *P. gracilis*, *P. tenella*, and *P. congesta*, and are rarely found in *P. megalocephala* var. *oligophylla* (*Howell 3906*), *P. villosa* (*Sikes 100*), and *P. megalocephala* var. *intricata* (*Langenheim 3746*). *Perityle gracilis* is limited in distribution, tetraploid (based on counts from one population), and probably derived from *P. stansburii*. *Perityle tenella* and *P. congesta* also are limited in distribution, have chromosome numbers of $x=16$, and are considered to be derived taxa. The rare occurrence of pappus bristles in the two varieties of *P. megalocephala* and *P. villosa* possibly reflects the retention of ancestral genes in some relatively closed populations, but it is considered very unlikely that any of these taxa represent a primal position in the southwestern alliance.

Judging from morphological differences, chromosome numbers, and distribution, *P. villosa*, *P. inyoensis*, *P. tenella*, *P. congesta*, and the southern populations of *P. megalocephala*, appear to have had early divergence from *P. stansburii*. Morphologically, the populations of *P. megalocephala* var. *megalocephala* from southwestern Nevada appear most closely related to *P. stansburii*, and their geographic position also suggests the most recent separation. Geographically and morphologically, *P. gracilis* ($n=34$) also appears to have had recent derivation from *P. stansburii* ($x=17$).

After reviewing the above discussions, one might well be stimulated in an attempt to explain a basis for the lack of apparent affinity between related-species groups of sect. *Laphamia*. In other words, is the section actually polyphyletic, or is the hiatus between each related-species group a reflection of differential response to varied environmental influences on taxa which underwent early divergence from a common Laphamian ancestor? A concept of polyphyletic origin from sect. *Perityle* would mean that the loss or reduction in at least two characters, pappus squamellae and prominent pubescence of achene margins, occurred independently in the development of several related-species groups. The loss of pappus parts concomitant with speciation

can be demonstrated in all three sections of *Perityle*, but only in presumably ancestral yellow-flowered members of sect. *Perityle* (eg. *P. cordifolia*) are there instances in which reduction in pappus squamellae and achene margin pubescence have occurred together. I must hasten to add that my observations should not lead one to dismiss the possibility of polyphyletic origin of sect. *Laphamia* species from sect. *Perityle*, especially because the tendency for correlated evolution of more than one character is not uncommon in the Helenieae (Ornduff, 1966).

The development of Laphamioid achene and pappus characters from species of sect. *Pappothrix* is quite another matter. The *Pappothrix* pappus is typified by a crown of 20-30 bristles, but both pappus squamellae and long-pubescent achene margins are lacking in species of this group. In one species of sect. *Pappothrix, P. vitreomontana*, the pappus is reduced to 2(3-10) bristles (Powell, 1969). If this trend toward reduction in pappus bristles were continued, then achenes almost indistinguishable from the Laphamioid type would result. The latter might have occurred in the evolution of *P. bisetosa* and *P. warnockii*. Eventually it may prove desirable to place these white-flowered species with sect. *Pappothrix*. At this time, however, it seems best to recognize a more conservative (and convenient) sect. *Laphamia*, at least until it can be determined if *P. castillonii*, and perhaps other species, had similar origin from sect. *Pappothrix*.

If sect. *Laphamia* is polyphyletic, then of course this treatment is an unnatural one, but it does bring some infrasectional systematic order to the complex phylad. Various avenues of experimentation currently are being explored, and it is hoped that a better understanding of intersectional and infrasectional phylogeny will emanate in the near future. Additional information regarding systematic relationships is discussed with the respective species in the taxonomic portion of this paper.

SPECIES CONCEPT

The species concept which has emerged from systematic studies in the subtribe Peritylinae closely parallels that which was expressed by Cronquist (1947) in his monograph of *Erigeron*. Essentially, in sect. *Laphamia*, species are recognized as taxa which exhibit consistent morphological distinctiveness in several characters and are isolated from one another by geographic barriers to gene exchange. The latter criterion is a reflection of the afore mentioned conclusion that none of the species occur sympatrically.

The apparent occurrence of speciation through geographic isolation has strongly influenced an attempt to arrive at a phylogenetically oriented species concept in this phylad. Experimental crosses with several species have shown that F_1 hybrids can be created between any interspecific combination, although differential F_1 sterility is expressed among the taxa. Artificial intersectional fertility is also common in the genus *Perityle*. It is obvious, therefore, that any attempt to incorporate reproductive criteria into a species concept would be undesirable, at least until fertility data are

studied. Quite simply, in sect. *Laphamia* (and sect. *Pappothrix*; Powell, 1969), it would seem that initial geographic isolation of taxa precluded a "necessity" for the establishment of genetic barriers to gene exchange, and that truly genic strictures of interspecific fertility still are being accumulated as concomitants of continuing independent evolution.

Infraspecific categories have been designated as varieties. Formal recognition has been given to populational entities which have attained only partial, marginal, geographic separation from the main body of a given species, and which differ consistently from the rest of the species by one or a few characters, or to populational entities which appear completely isolated from the parent species but exhibit only slight morphological or chromosomal differences.

It must be pointed out that I can feel confident of having obtained "adequate" populational surveys in but a few species of sect. *Laphamia*. Judging from the number of undescribed taxa which have come from these studies already, one cannot depend too heavily upon previous collections. Distressingly large areas within the distributional ranges of several species have not been examined at all. Shortcomings in collecting *Perityle* often are dictated by the extremely rough topography in many areas of the southwestern United States and northern Mexico. Many times it is necessary to provide oneself with a 4-wheel drive vehicle, drive into country with poor roads, or no roads at all, and climb hundreds of feet to a promising bluff habitat. In short, it has been physically impracticable to visit many localities in search for a better populational understanding of *Perityle* species. Consequently, it has been necessary to extrapolate in making some systematic judgments. I have attempted to maintain a conservative approach to problems where inadequate information would be likely to influence a spurious nomenclatural decision. The reader will notice numerous instances where "anomalous populations" or similarly ambiguous problems are referred to further study.

TAXONOMY

PERITYLE sect. LAPHAMIA (A. Gray) Powell, Sida 3:277. 1968.

Laphamia A Gray, Pl. Wright. 1:101. 1852.
Monothrix Torr. in Stansbury's Exp. 390. 1852.
Leptopharynx Rydb., N. Amer. Fl. 34:21. 1914. (in part)

Plants suffrutescent perennials, growing from crevices of solid rock exposures, from 2-60 cm high, glabrous to variously pubescent, typically glandular-pubescent; leaves opposite or alternate, usually alternate, extremely variable in size and shape, 0.5-11.0 cm long including the petiole, 0.3-6.0 cm wide, linear-lanceolate, ovate, palmate, tending to be tripartite in most species, variously serrate, lobed, cleft, or divided to pinnate, glabrous to pubescent, usually minutely glandular-punctate, viscid, bitter tasting, sessile or petiolate; capitulescence of solitary heads, or heads loosely to tightly aggregated in clusters of 3 or more; peduncles very short so that

heads are partially subtended by cauline leaves, or long with heads distinctly raised above leaves; involucres subcylindric to broadly campanulate, heads 0.5-1.1 cm long, 0.4-1.2 cm wide; involucre of 2 equal or subequal series, in some species seemingly either once or thrice seriate, inner bracts essentially like the outer except slightly wider and more membranous; bracts linear, oblong, lanceolate, flattened or keeled; ray flowers present or absent, ligules yellow, oblong to suborbicular, 2.5-7.0 mm long, 1.2-3.8 mm wide; disc corollas four-lobed, white or yellow, 2.2-6.5 mm long, tubes minutely glandular-pubescent (glandular-pilose in *P. warnockii*), throats cylindric to narrowly campanulate, typically sparsely glandular-pubescent, lobes typically reflexed and acute; style branches 1.0-3.0 mm long, linear, flattened, tapering to a minutely pubescent tip; achenes black when mature, 2.0-3.8 mm long, distinctly flattened radially, often obscurely rounded or angled on one or both surfaces, linear, linear-oblong to narrowly oblanceolate in outline, outer ones often slightly curved and partially clasped by bract, with conspicuous or inconspicuous callous margins (rarely absent), typically short-pubescent on margins and surfaces, rarely glabrous; pappus absent or of 1 or 2 (rarely 3-6) bristles, the bristles arising from the achene margins, 0.5-4.6 mm long, naked or minutely antrorse-ciliate distally, pappus also of inconspicuous, vestigial, hyaline squamellae, or the squamellae absent, revealing just a callous crown; anthers 4, 1.5-3.0 mm long; base chromosome number, $x=17$.

Type: *P. lindheimeri* A. Gray.

KEY TO THE SPECIES

1a. Flowers white; plants 2-8 (12) cm high; pappus absent or typically of 2 rather flattened bristles.
  2a. Pappus absent; leaves scabrous-pubescent . . . 1. *P. warnockii.*
  2b. Pappus typically of 2 bristles; leaves essentially glabrous, except in var. *scalaris* . . . . . 2. *P. bisetosa.*
1b. Flowers yellow; plants usually exceeding 12 cm high; pappus absent or of 1-3 (6) rounded bristles.
  3a. Heads radiate.
    4a. Plants, especially stems, pilose-villous; achenes epappose; Sonora, Sinaloa.
      5a. Leaves 8-11 cm long, 4-6 cm wide; Sinaloa . 20. *P. grandifolia.*
      5b. Leaves 1.5-2.5 cm long, 0.8-1.8 cm wide; Sonora . . . . . 21. *P. gentryi.*
    4b. Plants essentially glabrous or short-pubescent; pappus of 1-2 (6) bristles, rarely none; Utah, Nevada, Arizona, New Mexico, Texas.
      6a. Florets ca. 16-22 per head; capitulescence usually of tightly aggregated heads on short peduncles; leaves broadly ovate to ovate-lanceolate; Texas . . . . . 15. *P. lindheimeri.*
      6b. Florets exceeding ca. 30 per head; capitulescence of several, loosely aggregated heads, or few heads on long peduncles; leaves

subovate to variously tripartite, or lobed, divided, or pinnate.

7a. Leaves usually subcruciform but also merely lobed or pinnate; New Mexico . . . . . 17. *P. staurophylla.*

7b. Leaves ovate to deeply divided or pinnate; Utah, Nevada, Arizona.

8a. Florets less than 100; leaves subovate to suborbicular, serrate to shallow-lobed; Utah and NE Nevada . . 3. *P. stansburii.*

8b. Florets exceeding 100; leaves deeply dissected or pinnate; Arizona.

9a. Leaves typically pinnately trifoliate with segments much broadened distally . . . . . 11. *P. gilensis.*

9b. Leaves tri- to bipinnate with long, linear to flat-filiform segments . . . . . 10. *P. saxicola.*

3b. Heads discoid, except ligules rarely present in *P. lemmoni.*

10a. Plants relatively long-pubescent, villous, pilose, pilose-hirsute, occasionally sparse-pilose in *P. castillonii.*

11a. Leaves deeply dissected and divided into numerous irregular lobes, merely serrate-lobed in a population of *P. lemmoni.*

12a. Pappus bristle(s) rather stout; bracts attenuate; disc corollas tubular; Presidio-Brewster Co., Texas, and adjacent Chihuahua, Mexico . . . . . 13. *P. dissecta.*

12b. Pappus bristle(s) rather delicate; bracts acute; disc corollas broad-tubular to subfunnelform; SE Arizona . . . . . 12. *P. lemmoni.*

11b. Leaves serrate, shallow-lobed, or entire.

13a. Florets 16-30; disc corollas 2.2-3.5 mm long, turning purplish at maturity; 1-2 pappus bristles usually present; E. Chihauhua and W. Coahuila, Mexico . . . . . 14. *P. castillonii.*

13b. Florets 30-75; disc corollas 4-5 mm long, not turning purplish at maturity; pappus bristles usually absent (rarely 1-2 bristles in *P. villosa*); Inyo and Panamint Mts., California.

14a. Leaf margins regularly serrate-lobed; leaves opposite or alternate . . . . . 6. *P. inyoensis.*

14b. Leaf margins entire, or with 1-3 lobes per margin, leaves alternate . . . . . 7. *P. villosa.*

10b. Plants relatively short-pubescent, hispidulous, hirtellous, short pilose-hirsute in *P. tenella,* or essentially glabrous.

15a. Plants essentially glabrous, occasionally puberulent to hispidulous in *P. cochisensis.*

16a. Achenes typically epappose; limestone rocks; SW Texas . . . . . 16. *P. angustifolia.*

16b. Achenes with pappus of 1-2 bristles; Coahuila, Mexico, Arizona.

17a. Plants 4-12 cm high; involucres campanulate; Chiricahua Mts., SE Arizona . . . . . 19. *P. cochisensis.*

17b. Plants 15-35 cm high; involucres nearly cylindrical; SW

Coahuila, Mexico . . . . . 18. *P. coahuilensis.*

15b. Plants pubescent, occasionally nearly glabrous in *P. gracilis.*

18a. Pappus absent, rarely of 1-2 bristles in var. *intricata*; stems leafy, especially toward the base in var. *megalocephala*, stems with a few, small leaves to nearly naked in var. *oligophylla* and var. *intricata*; SW Nevada and adjacent California . . . . . 4. *P. megalocephala.*

18b. Pappus of 1-2 (3) bristles; stems copiously leafy; SE Nevada, SW Utah, NW Arizona.

19a. Leaves 3-cleft, tripalmate, to subcruciform; SW Nevada . . . . . 5. *P. gracilis.*

19b. Leaves broadly deltoid-ovate to subcordate and serrate, or ovate to ovate-elliptic and entire, serrate, or shallow-lobed.

20a. Leaves broadly deltoid-ovate to subcordate, serrate; SW Utah and adjacent NW Arizonia. . . . 8. *P. tenella.*

20b. Leaves ovate, ovate-lanceolate, to ovate-elliptic, entire, serrate, or shallow-lobed; Grand Canyon area, Arizona . . . . . 9. *P. congesta.*

1. PERITYLE WARNOCKII Powell, Sida 3:177. 1966.

TYPE: TEXAS: Val Verde Co. NW part of county, in crevices and small pockets of solid Cretaceous limestone exposures, ca. 40-50 mi NE of Dryden, ca. 1 mi E of Pecos River, 11 Oct 1964, *Powell 1311* (Holotype, SRSC! Isotypes, GH! SMU! TEX!).

Plants 2-10 cm high, scabrous-pubescent, densely leafy; leaves opposite below, alternate above, 0.8-1.5 cm long, 0.4-0.8 (1.0) cm wide, scabrous-pubescent, suborbicular, ovate, to ovate-lanceolate, margins conspicuously serrate, acute at the apex, cuneate at the base; petioles 2-5 (8) mm long; capitulescence of solitary heads borne on short peduncles (1-7 mm long); involucres campanulate, heads 7-10 mm long, 4-7 mm wide, often partially obscured by subtending leaves; receptacle flattened, 1.0-1.5 mm wide; involucral bracts 9-10, 5-7 mm long, 1.2-2.2 mm wide, obscurely keeled, hirtellous; ray flowers absent; disc flowers, 9-12, corollas bright white, 5-6 (6.5) mm long, the tube 1.0-1.3 mm long, glandular-pilose, the throat subfunnelform, sparsely gladular-pilose, the lobes attenuate-acute, (1.0) 1.2-1.6 mm long; style branches white, ca. 2.0 mm long; achenes 2.2-2.5 (2.8) mm long, oblong to oblong-obconical, truncate at the base and apex, often rounded or obscurely angled on one or both surfaces, with conspicuous callous margins, the margins glabrous, minutely pubescent on achene surfaces; pappus absent; chromosome number, $n=17$.

Known only from the type locality. Fig. 3. Spring-Fall.

Perityle warnockii is clearly related to *P. bisetosa* as evidenced by its similar, and in some instances reduced, vegetative and floral morphology. The species is delimited primarily by its epappose achenes and scabrous-pubescent leaves which are typically suborbicular to ovate with conspicuously serrated margins.

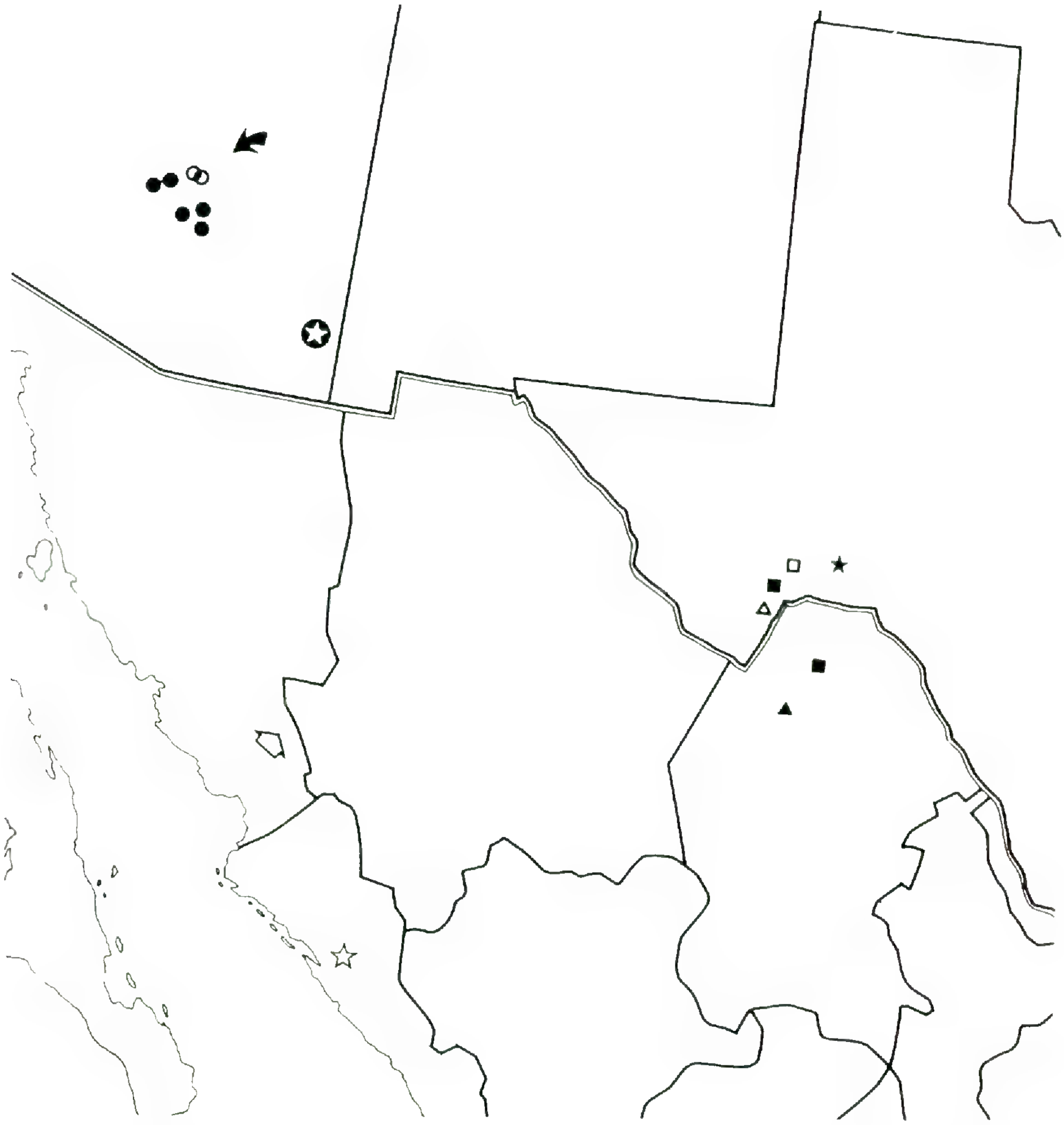

Fig. 3. Distribution of *P. bisetosa* var. *bisetosa* (open square); *P. bisetosa* var. *scalaris* (open triangle); *P. bisetosa* var. *appressa* (closed squares); *P. bisetosa* var. *spathulata* (closed triangle); *P. warnockii* (closed star); *P. saxicola* (open circles); *P. gilensis* var. *gilensis* (closed circles); *P. gilensis* var. *salensis* (closed arrow); *P. cochisensis* (open star circled); *P. grandifolia* (open star); *P. gentryi* (open arrow).

Both *P. warnockii* and *P. bisetosa* were derived independently from a common ancestor (perhaps white-flowered *Pappothrix*, e.g., *P. vitreomontana*). Neither taxon has a combination of morphological features which are suggestive of having been derived from the other. The epappose achenes of *P. warnockii* reveal the possibility of reduction from *P. bisetosa*, but it seems unlikely that the larger, pubescent leaves of *P. warnockii* could have come from *P. bisetosa*.

2. PERITYLE BISETOSA (Torr. ex A. Gray) Shinners

KEY TO THE VARIETIES

1a. Leaves subsessile or short-petiolate (1-2 mm), usually opposite, essentially glabrous, margins entire to subserrate; Texas . . . . . 2a. var. *bisetosa*.

1b. Leaves distinctly petiolate (2-7 mm), distinctly alternate, glabrous or hispidulous, margins distinctly serrate; Texas and Coahuila, Mexico.

2a. Leaves scabrous-hispidulous; Texas . . . . . 2b. var. *scalaris*.

2b. Leaves essentially glabrous; Texas, Mexico.

3a. Leaves ovate, 1.0-1.5 cm long, 0.4-0.8 cm wide, Texas and Coahuila, Mexico . . . . . 2c. var. *appressa*.

3b. Leaves oblanceolate-spathulate, 0.7-1.2 cm long, 0.2-0.4 cm wide; Coahuila, Mexico . . . . . 2d. var. *spathulata*.

2a. PERITYLE BISETOSA (Torr. ex A. Gray) Shinners var. BISETOSA, Southwest. Nat. 4:204. 1959.

Laphamia bisetosa Torr. ex A. Gray, Pl. Wright. 2: 106. 1853. TYPE: TEXAS: Brewster Co. crevices of rocks in a canyon of the Rio Grande below Presidio del Norte, Oct, 1852, *C. C. Parry s.n.* (Holotype, GH! Isotype, NY!).

Plants 2-7 (10) cm high, stems minutely pubescent, densely leafy; leaves usually opposite, less often alternate, 0.5-1.0 cm long, 0.2-0.6 cm wide, essentially glabrous, glandular-punctate, coriaceous, ovate, ovate-lanceolate, to lanceolate, margins entire to subserrate, often subundulate, acute at the apex; subsessile or short petiolate (1-2 mm); capitulescence typically of solitary heads (rarely 2) on very short peduncles; involucres narrowly campanulate, heads 7-8 (10) mm long, 3.5-7.0 mm wide, subtended and mostly obscured by leaves; receptacle flattened, 1.0-1.5 mm wide; involucral bracts 8-10 (12). 4.5-5.5 mm long, 1.0-2.0 mm wide, keeled; ray flowers absent; disc flowers 11-17, corollas white, (3.5) 4.2-4.8 mm long, the tube 0.8-1.0 mm long, the throat tubular to subfunnelform 1.5-2.5 mm long, the lobes acute, 0.8-1.0 mm long; style branches (1.0) 1.5-2.0 mm long; achenes 1.8-2.2 (2.5) mm long, oblong to oblong-obconical, often rounded or obscurely angled on one or both surfaces, with conspicuous callous margins, the margins glabrous, minutely pubescent on achene surfaces; pappus of 2 flattened bristles, 1.5-2.3 mm long; chromosome number, $n = 17$.

Very restricted in occurrence, crevices and pockets of limestone exposures. Fig. 3. Spring-Fall.

Specimens examined:

TEXAS: Brewster Co. 7.1 mi SW of US 90 on road to Cox Ranch, *D. Flyr 229* (SRSC); low white hills, Cox Ranch, 7.1 mi SW of Hwy 90, near Longfellow, *A. M. Powell 1370* (SRSC); McRae Canyon, Cox Ranch, *B. H. Warnock 11418* (SMU, SRSC); Cox Ranch, 65 mi SE of Alpine, *Warnock 18643* (SRSC).

The type locality given for var. *bisetosa* (canyon of the Rio Grande below

Presidio del Norte) is at Presidio, Texas (or Ojinaga, Mexico), but *P. bisetosa* is not known to have been collected along the Rio Grande near Presidio. Also, the area in question does not appear to offer the typical habitat for the taxon. More likely the type locality could have been below Mt. Carmel (Sierra del Carmen) along the Rio Grande, the only region in which *P. bisetosa* has been discovered, except for 2 localities south and east of Sierra del Carmen in Mexico.

Perityle bisetosa is indeed a remarkable species. Its reduced habit, white flowers and bisetose pappus of flattened bristles set it apart from all other taxa in sect. *Laphamia*. The species exhibits clearly what is believed to be a very important evolutionary trend in *Perityle*, i.e., geographic isolation serving as a primary impetus for speciation. The area in which *P. bisetosa* occurs is relatively dry, and has been severely eroded, leaving numerous limestone habitats exposed as "caprocks," hills, mesas, pinnacles, and canyons. Four varieties of *P. bisetosa* have been recognized. Each seems to be isolated completely from the others, and each apparently has evolved independently after becoming geographically separated. With reference to the evolutionary history of *P. bisetosa*, one might visualize that as erosion of the countryside progressed, small colonies became stranded and therefore subject to the evolutionary forces of small populations.

There is some evidence that *P. bisetosa* evolved from a white-flowered member of sect. *Pappothrix*, such as *P. vitreomontana*. The typical *Pappothrix* pappus is comprised of 20-30 bristles, but that of *P. vitreomontana* is reduced to 2(3) main bristles with several vestigial nubs. *Perityle vitreomontana* apparently evolved in response to increasing aridity at the periphery of the *Pappothrix* range after becoming geographically segregated (Powell, 1969). The morphology and ecology of *P. bisetosa* suggests that it continued the trend toward reduction in pappus bristles, which is manifested in *P. vitreomontana*, in still more arid regions located to the south of the latter species. Not only do the bisetosa pappus and gross morphology indicate a connection between *P. vitreomontana* and *P. bisetosa*, but in var. *appressa* and var. *scalaris* 3-5 bristles have been observed, with 1-3 of them reduced to vestigial nubs. Additionally, the occurrence of a few 3-4 angled achenes in var. *appressa* suggests that the distinctly flattened achenes typical of *P. bisetosa* were derived from the flattened but obscurely 4-angled achenes of *Pappothrix* species.

2b. PERITYLE BISETOSA var. SCALARIS Powell, Sida 3:177-178. 1967.

TYPE: TEXAS: Brewster Co. in crevices of lower limestone bluffs, Black Gap Game Preserve, ca. 4 mi S of headquarters, Cave Hill, E side, along Stairstep Mt., 25 Sept 1965, *A. M. Powell and T. Watson 1394* (Holotype, SRSC! Isotype, TEX!).

Plants 6-12 cm. high, in small, erect or pendulous clumps; leaves opposite below, alternate above, 8-12 mm long, 5-8 mm wide, scabrous-hispidulous, broadly ovate to suborbicular, with 1-2 shallow lobes per margin or merely serrate, the lobes and serrations acute; petioles 2-4 mm long; floral features

mostly slightly larger than in var. *bisetosa*, but otherwise the same, except pappus in some heads of 3 (4) bristles of equal length or with 1-2 reduced; chromosome number, $n = $ ca. 102.

Single population known only from the type locality. Fig. 3. Spring-Fall.

2c. PERITYLE BISETOSA var. APPRESSA Powell, Sida 3:178-180. 1967.

TYPE: TEXAS: Brewster Co. east face of the limestone caprock of a small mountain peak on the N rim of San Francisco Creek Canyon, 5 July 1966, *J. Scudday, S. Sikes*, and *A. M. Powell 626* (Holotype, SRSC! Isotypes, GH! SMU! TEX! US!).

Plants 4-8 cm high, 12-20 cm broad, growing in dense, leafy clumps closely appressed to rocks; leaves distinctly alternate (rarely opposite below), 1.0-1.5 cm long, 0.4-0.8 cm wide, glabrous, ovate, serrate or serrate-sinuate to shallow lobed, typically 2-3 (rarely 4) serrations or lobes per margin, the serrations obtuse to subacute; petioles 3-7 mm long; pappus typically of 2 bristles, rarely 3 (5), with at least 1-3 reduced; chromosome number, $n = 17$.

Restricted to caprock bluffs. Fig. 3. Spring-Fall. Specimen examined:

MEXICO: Coahuila: Colorado Canyon, Serranias del Burro, *D. Patterson* and *R. Quiñones* 77 (SRSC).

2d. PERITYLE BISETOSA var. **spathulata** Powell, var. nov. Fig. 4.

TYPE: MEXICO: Coahuila: limestone bluffs in large, dead-end Boquilla Canyon, Sierra de la Encantada, ca. 92.5 mi NW of Musquiz, 22 May 1968, *A. M. Powell* and *D. Patterson 1588* (Holotype, SRSC! Isotypes, SMU! TEX!).

Plantae 4-10 cm altae caespitosae, brevipendulosae vel ad saxa appressae; folia distincte alterna, 0.7-1.2 cm longa, 0.2-0.4 cm lata, glabra, oblanceolato-spathulata, ad laminae dimidium apicale 3-5 serrato-lobata, petiolis tenuibus laminas subaequantibus vel paulum brevioribus; chromosomata $n = 17$.

Single population known only from the type locality. Fig. 3. Spring-Fall.

3. PERITYLE STANSBURII (Gray) Macbride, Contrib. Gray Herb. n.s. 56:39. 1918.

Laphamia stansburii Gray, Pl. Wright. 1:101. 1852. TYPE: UTAH: Tooele Co. crevices of limestone rocks Stansbury's Island, 26 June 1850, *Stansbury s.n.* (Holotype, NY! Isotypes, GH! NY! Photograph, DS!).
Monothrix stansburyana Torr. in Stansbury's Exp. 390. 1852.
Monothrix stansburii (Gray) Rydb. N. Amer. Fl. 34:21. 1914.

Plants 25-45 cm high, often in dense clumps to 60 cm across, hirtellous; leaves mostly alternate, less often opposite, 0.9-1.6 (2.0) cm long, 0.5-1.0 (1.4) cm wide, hirtellous, typically broadly subovate, but varying from subdeltoid to sub-orbiculate, typically 2-5 (6) lobed or serrate, less often trilobed or subentire; petioles (2) 3-8 mm long; capitulescence of solitary heads or subcymose clusters; peduncles rather stout, usually 1-6 cm long; involucres campanulate, heads 7-8 mm long, 5-9 mm wide; receptacle convex to short-conical, rarely somewhat flattened, 1.5-2.2 mm wide, 0.3-1.0 mm high; involucral bracts 16-21, 5-6 mm long, 1.0-1.9 mm wide, lanceolate to

Fig. 4. *Perityle bisetosa* var. *spathulata*: photograph of holotype (SRSC), *Powell and Patterson 1588*.

broadly oblanceolate, strongly keeled; ray flowers 12-14, pistillate and fertile, tube 1.6-2.2 mm long, ligules yellow, 3.0-5.5 mm long, 1.2-1.9 mm wide, typically oblong, less often subelliptic, 3-lobulate at the apex; disc flowers 60-80, corollas yellow, 4-5 mm long, the tube 1.2-1.5 mm long, the throat tubular or subfunnelform, 2.4-2.9 mm long, the lobes acute, 0.4-0.6 mm long; style branches 2.0-2.6 mm long; achenes 2.3-3.4 mm long, typically narrowly obconical, less often suboblong to obconical-elliptic, always smaller at the base, usually somewhat rounded on both surfaces, rarely angled on one surface, with thin callous margins, short-pubescent on the margins especially, and both surfaces; pappus of a single, rather stout bristle, 2.5-4.0 mm long, and a very small crown of hyaline squamellae, the bristle often tending to terminate abruptly as a bluntish point; chromosome number, $n=17$.

Common in crevices of rock exposures in NW and W Utah and NE Nevada. Fig. 5. Spring-Fall. Representative specimens:

NEVADA: Elko Co. Wendover, *M. E. Jones s.n.* (RM); Loomis Pasture, NW of Wells, *C.O. Land s.n.* (POM, UC). White Pine Co. W slope of Sacramento Pass, *H. D. Ripley & R. C. Barneby 9273* (NY). UTAH: Beaver Co. Minerville, *Ripley and Barneby 9249* (CAS, NY); Wah Wah Mts., 35 mi W of Milford, *R. C. Rollins and T. S. Chambers 2463* (DS, GH, RM, UC). Grand Co. Moab, *M. E. Jones s.n.* (POM). Juab Co. Thomas Creek, Deep Creek Mts., *W. P. Cottam 3234* (UT); 12 mi E of Troutcreek, *B. Maguire and R. J. Becraft 2855* (US); 13 mi from Troutcreek, *Maguire and Becraft 2856* (GH, RM, UC); 25 mi SW of Eureka, *Maguire 20752* (GH, NY), Granite Creek, Deep Creek Range, *Maguire and A. H. Holmgren 21918* (GH, NY, US). Millard Co. Warm Spring, *Cottam 3267* (UT); Gandy, *Cottam 8157* (UT); Garrison, *Jones s.n.* (POM); House Range, 56 mi W of Delta, *Maguire and Becraft 2857* (GH, POM, RM, US); 1.8 mi S of Garrison, *Maguire 20851* (NY, US); House Range, 47 mi W of Delta, *Maguire 21056* (GH, NY, US); Pruess Lake, near Garrison, *F. W. Peirson 7537* (CAS, RSA); E of Skull Rock Pass, 51 mi SW of Delta, *A. M. Powell 1270* (SRSC); near Preuss Lake, *I. Tidestrom 11161* (US); Skull Rock Pass, Confusion Range, *S. L. Welsh and G. Moore 2230* (NY). Salt Lake Co. Garfield, *A. O. Garrett 2794* (UT); Garfield, *W. W. Jones s.n.* (UC). Sanpete Co. Fairview, *Jones s.n.* (POM); Route 25, Soldier Fork Canyon, Wasatch Mts., *F. W. Pennel, R. D. Johnson and R. L. Schaeffer 22753* (NY); W of Sterling, *Tidestrom 1307* (RM, US). Sevier Co. Gooseberry ranger station, Fishlake Nat'l Forest, Wasach Mts., *W. W. Eggleston 10378* (US). Tooele Co. Stansbury Island, *K. Brizzee 7803* (UT); Thomas Creek, Deep Creek Mts., *Cottam 3247* (UT); Stansbury Isl., *Cottam 9185* (RSA, UT); near Low, *A. Eastwood and J. T. Howell 380* (CAS, GH); base of Camel Back Mts., SW part of county, *S. Flowers 10* (UT); North Point, Stansbury Mts., *Flowers 1294* (UT); W side of Great Salt Lake, *Garrett 5334* (DS, RUM, UT); Stansbury Isl., *Garrett 8474* (CAS, RSA, SMU, UC, US); Ophir Canyon, *Garrett 8815* (UC, UT); W of Grantsville, *Jones 25582* (CAS, DS, ND, POM); Stansbury Isl., *Jones s.n.* (CAS, DS, ND, NMC, NY, POM, RM, UC, US); Granite Mts., *Jones s.n.* (POM);

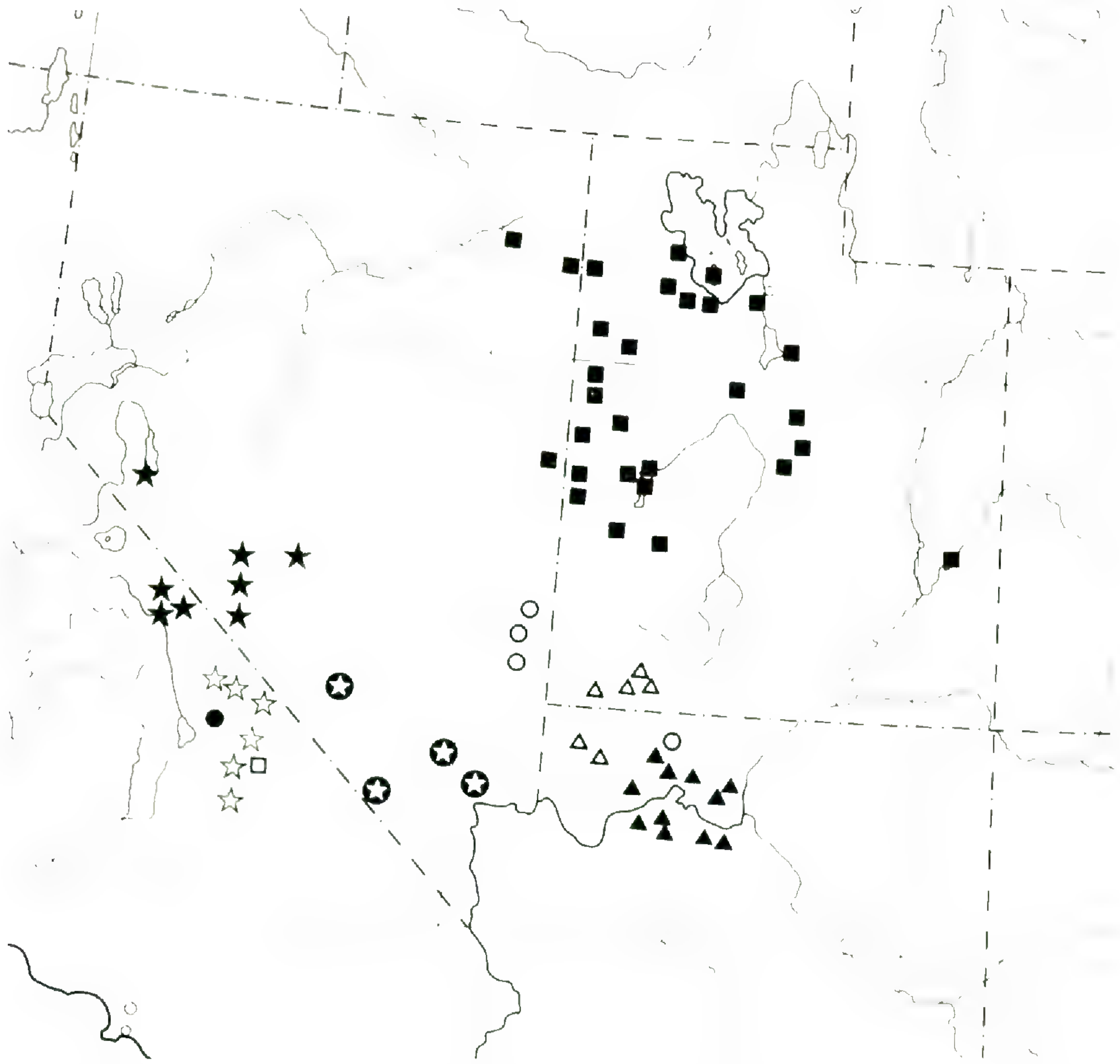

Fig. 5. Distribution of *P. stansburii* (closed squares); *P. megalocephala* var. *megalocephala* (closed stars); *P. megalocephala* var. *oligophylla* (open stars); *P. megalocephala* var. *intricata* (open stars circled); *P. inyoensis* (closed circle); *P. villosa* (open square); *P. gracilis* (open circles); *P. tenella* (open triangles); *P. congesta* (closed triangles).

Buent Sta., Dutch Mt., *Jones s.n.* (POM); Wendover, *Jones s.n.* (POM); Stansbury Isl., *F. E. Leonard s.n.* (DS, GH, NY, UC); S shore of Great Salt Lake, 13.5 mi W of Grantsville, *Maguire, R. Maguire, and B. C. Maguire 5652* (UC, GH); 43 mi W of Salt Lake City, *Maguire 16731* (POM, UC); Route 40 NW of Grantsville, *F. W. Pennell and R. L. Schaeffer 22852* (NY, US); NW end of Stansbury Island, *Powell and Calvert 1269* (SRSC); Mt. Flux, *Ripley and Barneby 5512* (CAS, NY); Stansbury Isl., *G. Saccomanno 7667* (UT); Stansbury Isl., *S. Watson 587?* (NY, US). Utah Co. Rock Canyon near Provo, *Garrett 3329* (GH, US, UT); S of Black Rock, Salt Lake, *Garrett 8239* (DS, UT); Rock Canyon, *B. F. Harrison 8563* (UT); Provo, *Jones 5555* (NY, RM, UC, US).

The relatively wide ranging *P. stansburii* is clearly related to *P. megalocephala*. In fact, when examining herbarium specimens, the two species are difficult to separate if well-developed heads have not been preserved. Normally, *P. stansburii* is easily distinguished from *P. megalocephala* by its radiate heads and pappus of a single bristle.

As discussed elsewhere, *P. stansburii* is regarded as ancestral in a group of seven species designated as the southwestern alliance (see Phylogenetic Considerations). Even though other phyletic lineages are possible for the southwestern alliance, *P. stansburii* appears to be the only taxon which possesses a combination of supposedly ancestral features from which the other species could have derived their phenotypic appearances. Briefly, *P. stansburii* is large in habit, has relatively broad leaves, radiate heads, pappus of a bristle, and a chromosome number of $x = 17$, all presumably ancestral in this alliance.

4. PERITYLE MEGALOCEPHALA (Wats.) Macbride

KEY TO THE VARIETIES

1a. Leaves relatively copious, 0.7-1.5 (1.7) cm long, 0.4-0.9 (1.2) cm wide, ovate, lanceolate-ovate, subelliptic to suborbicular . . . . . 4a. var. *megalocephala*.

1b. Leaves relatively meager, 0.4-1.7 cm long, 0.1-0.4 (0.6) cm wide, lanceolate or linear.

2a. Capitulescence of solitary heads or loose clusters of 2-3 heads; peduncles (1.5) 2.0-5.0 cm long . . . . . 4b. var. *oligophylla*.

2b. Capitulescence of 2-6 heads in tight clusters; peduncles rarely exceeding 1 cm . . . . . 4c. var. *intricata*.

4a. PERITYLE MEGALOCEPHALA (Wats.) Macbride, var. MEGALOCEPHALA Contrib. Gray Herb. n.s. 56:39. 1918.

Laphamia megalocephala Wats. Amer. Nat. 7:301. 1873. TYPE: NEVADA: 1872, *Wheeler s.n.* (Holotype, US! Isotype, GH!).

Monothrix megacephala (Wats. ?) Rydb. N. Amer. Fl. 34:20. 1914.

Plants 30-55 cm high, often in dense, suffrutescent clumps, commonly 30-60 cm across, less often 90 cm across, profusely branched at the base and above, densely hirtellous; leaves mostly alternate, less often opposite, 0.7-1.5 (1.7) cm long, 0.4-0.9 (1.2) cm wide, becoming progressively smaller toward apex, hirtellous, ovate, lanceolate-ovate, subelliptic, to suborbicular, the margins typically entire to subentire rarely serrate to serrate-lobed, acute to obtuse or rounded at the apex; petioles 1-5 (6) mm long; capitulescence of solitary heads or of a few, loosely aggregated heads on peduncles of variable length; peduncles usually 1.0-4.5 (8.0) cm long, typically bearing small leaves; involucres campanulate, heads 6-9 (10) mm long, 5-6 (8) mm wide; receptacle convex and rounded to short conical, 1.5-2.0 mm wide, 0.5-1.0 mm high; involucral bracts 14-19, 5-6 mm long, 1.3-1.9 mm wide, lanceolate to suboblanceolate, keeled or with a rather prominent midvein;

ray flowers absent; disc flowers 45-60; corollas yellow, 3.5-4.2 mm long, the tube 1.0-1.6 mm long, the throat subtubular to subfunnelform, 1.8-2.2 mm long, the lobes acute, 0.4-0.7 mm long; style branches 1.8-2.0 mm long; achenes 2.5-2.9 (3.0) mm long, narrowly obconical to suboblanceolate, rounded or less often angled on one or both surfaces, with thin callous margins, pubescent on the margins and both surfaces; pappus absent, of a callous crown, or of vestigial, hyaline squamellae especially evident above the achene margins; chromosome number, $n = 17$.

Relatively common in volcanic rocks of arid mountains, southwest-central Nevada and adjacent California. Fig. 5. Spring-Fall.

Representative specimens:

CALIFORNIA: Inyo Co. Devil's Gate Waucoba Canyon, *A. M. Alexander* and *L. Kellogg 2541* (DS, GH, UC); N fork of Silver Canyon, 8 mi E from Laws, White Mts., *E. I. Applegate 6936* (DS); Silver Canyon, White Mts., *K. Brandegee s.n.* (UC); Black Canyon, *D. Cassell 273* (DS); Marble Canyon, *V. Duran 2845* (CAS, DS, GH, NY, POM, RM, RSA, UC); Westgard Pass, *E. C. Jaeger s.n.* (POM); Squaw Flat, Inyo Mts., NW of Waucoba Mts., *M. Kerr s.n.* (CAS, RSA); head of Marble Canyon, Inyo Mts., *P. A. Munz and J. C. Roos 20169* (CAS, NY, RM, UC); hill behind Blue Bell Mine, Badger Flat, Inyo Mts., *J. C. Roos and A. R. Roos 5938* (CAS, DS, NY, RSA, UC); Mazourka Canyon, Inyo Mts., *Roos and Roos 5979* (DS, NY, RSA); the Narrows, Marble Canyon, Inyo Mts., *Roos and Roos 6217* (CAS, NY, RSA); N fork of Silver Canyon, White Mts., *C. B. Wolf 2587* (CAS, DS, RSA). NEVADA: Esmeralda Co. Goldfield, *H. M. Hall 10537* (CAS, GH, UC); 3 mi below Pigeon Springs on the W side of Magruder Mt., *B. Maguire and A. H. Holmgren 25661* (CAS, DS, GH, NY, POM, UC); N end of Clayton Valley, *H. D. Ripley and R. C. Barneby 3657* (NY); Soda Springs Canyon, *W. H. Shockley 568* (DS, ND, POM, UC, US). Mineral Co. 1-3 mi from mouth, up Cory Creek, Wassuk Range, *W. A. Archer 6849* (DS, NY, UC); base of Wassuk Range, US Hwy 95 along Walker Lake, 13 mi N of Hawthorne, *R. S. Ferris 13100* (CAS, DS, NY, RM, RSA, TEX, US); 10 mi N of Hawthorne, *P. Train 4049* (NY, UC). Nye Co. 16 mi E of Warm Springs near Hwy 25, W of Nyala turn off, *A. M. Powell 1274* (SRSC); Tonopah, *W. H. Shockley 122* (DS, POM, RM, UC, US). Pancake Range, Nev., *C. A. Purpus 6341* (NY, POM, RM, UC, US).

Perityle megalocephala var. *megalocephala* appears to have close affinities with *P. stansburii* and *P. inyoensis*. Several distinctive features of var. *megalocephala* are best determined by consulting the above description, but essentially this taxon can be delimited from *P. stansburii* which has radiate heads, pappus of a single bristle, and acute-lobed leaves and from *P. inyoensis* which has a smaller habit, pilose-villous pubescence, and essentially opposite leaves which are ovate to ovate-deltoid with serrate-lobed margins. *Perityle megalocephala* var. *megalocephala* is discoid, epappose, large and profusely branching in habit (30-55 cm high, 30-60 cm across) and typically has hirtellous, ovate to suborbicular leaves.

4b. PERITYLE MEGALOCEPHALA var. **oligophylla** Powell, var. nov. Fig. 6.

TYPE: CALIF.: Inyo Co. Lost Burro Gap, Cottonwood Mts., Death Valley Nat'l Mon., 17 Sept 1957, *R. S. Ferris* and *W. R. Ernst 13162* (Holotype, DS! Isotypes, DS! RM! RSA! TEX! US!).

Plantae 15-35 cm altae, dense hirtellae, ramosissimae; caules tenues vel crassi, parce foliosi (vel quasi); folia alterna, 0.7-1.7 cm longa, 0.1-0.4 (0.6) cm lata, lanceolata ad linearia, petiolata; capitula solitaria vel 2-3 laxe disposita; pedunculi (1.5) 2.0-5.0 cm longi; flores sicut in var. *megalocephala* nisi capitulis paulum minoribus (3.5-7.5 mm latis) et raro pappo setae unicae; chromosomata $n=34$.

Relatively common but very ephemeral in protected areas or northern exposures in mountains of the Death Valley region, California. Fig. 5. Spring-Fall, when it rains.

Specimens examined:

CALIFORNIA: Inyo Co. Death Valley Canyon, Panamint Mts., *F. V. Coville* and *A. F. Gilman 89* (US); Death Valley Canyon, *Coville and Gilman 118* (US); right fork of Death Valley Canyon, Panamint Mts., *M. F. Gilman 1853* (US); Goodwin Spring, branch of Wildrose Canyon, *Gilman 2222* and *2223* (US); Wildrose Canyon, Panamint Mts., *Gilman 2224* (POM); Tin Mt., Cottonwood Mts., Death Valley Nat'l Mon., *Gilman 2676* (POM); gorge below Rest Spring, Cottonwood Mts., *Gilman 3896* (GH, POM); Leadfield Canyon, Death Valley region, *Gilman 4229* (POM); Surprise Canyon, Panamint Mts., *J. T. Howell 3906* (CAS, DS, GH, US); W entrance of Lost Burro Gap, Cottonwood Mts., *A. M. Powell and D. Patterson 1612* (SRSC).

Most collections here attributed to var. *oligophylla* have been recognized as var. *intricata* by several taxonomists (herbarium sheet annotations). The establishment of an additional variety of *P. megalocephala* is warranted in spite of the fact that much more populational information about the species needs to be gathered.

Perityle megalocephala var. *oligophylla* exhibits a meager complement of lanceolate to linear leaves, a consistent feature by which it can be delimited from the var. *megalocephala*. The variety is further characterized by its smaller habit, and disjunct distribution (Fig. 5), although the varieties perceptibly intergrade in Marble Canyon, Inyo Mts., California. No consistent floral differences have been detected between var. *oligophylla* and var. *megalocephala*. A chromosome number of $n=34$ has been obtained for var. *oligophylla* from one population (*Powell and Patterson 1612*). Further study will be necessary before it can be determined if the variety is consistently tetraploid. The var. *megalocephala* was found to be diploid ($n=17$), but thus far only one population has been examined chromosomally. The habit of some specimens of var. *oligophylla*, especially *Gilman 1853*, is suggestive of a relationship with *P. inyoensis*.

It is suspected that var. *oligophylla* evolved its meager leaves in response to extreme arid conditions, although plants of var. *megalocephala* also inhabit

DUDLEY HERBARIUM OF STANFORD UNIVERSITY
Plants of California
Lepharnia intricata Brandg.
Rounded dense masses growing in limestone rock crevices. In Lost Burro Gap, W face of Cottonwood Mts., Death Valley Natl. Monument
Inyo County
Alt. 9200 ft.
Rosaura S. Ferris & W.B.Ernst 13162
Sept. 17, 19
HOLOTYPE
STATE COLLEGE HERBARIUM
A. M. Powell
1970

Fig. 6. *Perityle megalocephala* var. *oligophylla*: photograph of holotype (DS), *Ferris and Ernst 13162*.

very dry areas. It should be noted also that collections of the few-leafed variety have been found at altitudes up to 8,350 feet (*Coville and Gilman 118*). The distribution of var. *oligophylla* is centered in the eastern Death Valley region and many localities at 4500-5000 feet receive sparse annual precipitation (e.g., Cottonwood Mts.). Plants of both varieties have been grown under uniform conditions in the greenhouse, and both have retained their typical growth habits.

The infraspecific taxonomic dispositions of *P. megalocephala* are based almost entirely upon morphological evidence. Chromosome numbers have been obtained only from single populations of var. *megalocephala* ($n=17$), var. *oligophylla* ($n=34$), and var. *intricata* ($n=19\pm1$). Chromatographic sampling has been equally deficient, but phenolic patterns of the southwestern species are so much alike that they are of limited value at the infraspecific level. However, the pattern obtained for var. *intricata* is quite different from those of the other varieties. Much additional populational study of *P. megalocephala*, particularly for chromosome numbers, will be necessary before the taxon is properly understood.

The larger leafed var. *megalocephala* is morphologically uniform over a fairly large area (Fig. 5). The leaves of a few collections are slightly reduced in size (e.g., *Applegate 6936 and Shockley 122*), but these do not really approach the narrow foliage characteristic of var. *oligophylla*. In Marble Canyon, California, however, some plants from the same collection (e.g., *Duran 2845*) exhibit leaf morphology like var. *megalocephala* and/or *oligophylla*. Other specimens from the southern California region north of Death Valley show narrow leaves like var. *oligophylla* (e.g., *Alexander and Kellog 2541* and *Roos and Roos 5979*) and some plants have a pubescence approaching *P. inyoensis*. The Marble Canyon population particularly has been interpreted as evidence that var. *megalocephala* and var. *oligophylla* intergrade. Elsewhere in their respective distributional areas, the two taxa appear to manifest genetic integrity.

One population, here relegated to var. *megalocephala*, is suggestive of hybridization with *P. inyoensis*—or perhaps it is merely indicative of recent contiguity between *P. megalocephala* and *P. inyoensis*. This is evidenced by some plants from a collection (*Roos and Roos 5938*) from near Blue Bell Mine, Inyo Mts., California, which are intermediate in habit between *P. megalocephala* and *P. inyoensis* and have pubescence approaching that of the latter taxon. Other plants from the same collection have leaves which resemble those of var. *oligophylla*. Further speculation about the intermediate variability is not advisable until more populational information can be obtained, but the close relationship of the taxa involved is apparent.

The controversial collection (*Howell 3906*) from Surprise Canyon, Panamint Mts., California, seems to belong with var. *oligophylla* rather than with *P. congesta* as indicated by Ferris (1959). Some plants of this collection have a single bristle, and along with *Langenheim 3746* of var. *intricata*, constitute the only specimens of *P. megalocephala* which are known to have

pappus bristles.

4c. PERITYLE MEGALOCEPHALA var. **intricata** (Brandeg.) Powell comb. nov.

Laphamia intricata Brandeg. Bot. Gaz. 27:450-451. 1899. TYPE: NEVADA: Sheep Mountain, on rocks, May-Oct, 1898. *C. A. Purpus 6134* (Lectotype, UC! Isolectotype, DS! US!) Pahrump Valley, May-Oct., 1898, *C. A. Purpus 6051* (Paratypes, NY! UC! US! Photograph, DS!).
Monothrix intricata (Brandeg.) Rydb. N. Amer. Fl. 34:20. 1914.
Laphamia megacephala Wats. subsp. *intricata* (Brandeg) Keck, Aliso 4:101. 1958.

Plants 13-35 cm high, subcanescent, profusely branched, stems slender, sparsely leafed; leaves few, alternate, 4-8 mm long, linear, sessile or petiolate; capitulescence of 2-6 tightly aggregated heads on short peduncles rarely exceeding 1 cm; floral features essentially like var. *oligophylla* except heads smaller; heads 4.0-6.5 mm long, 3.5-5.5 mm wide; corollas with well-differentiated tubes and throats, the throats broad-tubular; achenes coarse-pubescent on margins and surfaces; pappus of short cilia-like squamellae, rarely of 1-2 bristles.

Rare in dry mountains of S Nevada. Fig. 5. Spring-Fall, when it rains. Specimens examined:[2]

NEVADA: Clark Co. Muddy Mts., *J. Langenheim 3746* (UC); Nye Co. 23 mi W of Indian Springs, *T. Watson and J. Averett 250*; Checkpoint Pass, *P. V. Wells s.n.* (RSA); Checkpoint Pass, *P. V. Wells s.n.* (RSA).

Perityle megalocephala var. *intricata* differs considerably from the rest of the species. In fact, future study may reveal the taxon warrants specific recognition. Infraspecific status has been retained for var. *intricata* because it exhibits apparent affinity with *P. megalocephala* var. *oligophylla* and because very little biosystematic information has been obtained for the taxon.

Only five collections of typical var. *intricata* are known to me, including the types. One other collection with rather intermediate morphology, *Watson and Averett 250*, approaches var. *oligophylla*. This variety is similar to var. *oligophylla* in habit (excluding capitulescence), but its leaves are fewer and more reduced (linear to subfiliform) than those of var. *oligophylla*. Probably it is the paucity of foliage which has prompted previous workers to include var. *oligophylla* with var. *intricata*. The most conspicuous delimiting feature of var. *intricata* is its capitulescence of tightly aggregated heads on short peduncles. Typically the capitulescence of var. *megalocephala* and var. *oligophylla* is of solitary heads, although some plants of the latter varieties

[2] After this work was accepted for publication, J. T. Howell called my attention to an anomalous collection of *Perityle* from Utah (Grand Co., seepage on cliff of Colorado River canyon, 1 mi E of Moab bridge, el 4000 ft, 6 Sept 1968, *Howell and True 44841*, CAS). Tentatively, I have assigned the collection to var. *intricata* because of similarities in habit, achenes, and pappus. The Utah specimen differs from var. *intricata*, however, in its capitulescence of loosely clustered heads, involucral bracts, and shape of upper leaves. Eventually the Utah population might prove worthy of separate varietal status, or even warrant specific status as suggested by A. Cronquist (on the Howell and True label).

have a capitulescence of 2-3 heads in loose clusters on rather long peduncles. The var. *intricata* also differs somewhat from other populations of *P. megalocephala* by its smaller heads, shorter disc corollas with well differentiated tubes, achenes which are coarse-pubescent on the margins and surfaces, and a rather conspicuous crown of pappus squamellae (cilia). The latter feature is characteristic of the supposedly ancestral *P. stansburii*, as is the pappus of 1-2 bristles found only in the *Langenheim 3746* collection of var. *intricata*.

5. PERITYLE GRACILIS (M. E. Jones) Rydb. N. Amer. Fl. 34:19. 1914.

Laphamia gracilis M. E. Jones, Proc. Calif. Acad. Sci. 5:703. 1895. TYPE: ARIZONA: Below Nagle's Ranch, edge of Buckskin Mts., crevices of limestone rocks, 7000 ft, in very dry places, 15 Sept 1894, *M. E. Jones 6050c* (Holotype, POM; Isotype, US!).

Laphamia fastigiata Brandeg. Bot. Gaz. 27:451. 1899. TYPE: NEVADA: Sheep Mts., 4-5000 ft, May-Oct, 1898, *C. A. Purpus 6142* (Holotype, UC! Isotypes, US!).

Monothrix fastigiata (Brandeg.) Rydb. N. Amer. Fl. 34:21. 1914.

Perityle fastigiata (Brandeg.) Shinners, Southwest. Nat. 4:204. 1959.

Plants 10-17 cm high, densely puberulent to nearly glabrous; leaves alternate, 1.0-2.3 cm long, 0.5-1.5 cm wide, often extremely reduced at plant apexes, densely puberulent to nearly glabrous, typically 3-cleft, tri-palmate, subcruciform, or with 2-3 lobes per margin, the lobes or marginal segments lanceolate to oblong-lanceolate, acute, occasionally secondarily lobed below the distal segments, usually attenuate at the base; petioles 2-5 (7) mm long; capitulescence of solitary heads or small clusters borne on slender or stout peduncles (usually 0.5-1.5 cm long); involucres campanulate, heads 5-7 mm long, 4.0-5.5 mm wide; receptacle convex, flattened, 1.7-2.0 mm wide; involucral bracts (8) 14-17, 3.5-5.5 mm long, 0.7-1.2 mm wide, sublanceolate to linear-lanceolate, keeled; ray flowers absent; disc flowers 30-42, corollas yellow, (2.5) 2.8-3.6 mm long, the tube 0.8-1.1 mm long, the throat tubular to subtubular, (1.3) 1.6-2.0 mm long, the lobes acute, 0.4-0.6 mm long; style branches 1.2-1.8 mm long; achenes 1.8-2.5 (2.8) mm long, oblong-obconical, rounded or angled on one or both surfaces, with thin callous margins, short-pubescent on the margins and both surfaces; pappus typically of 1 rather stout bristle (rarely 2, 3, or none), 1-2 mm long, shorter than 1.0 mm, or vestigial, a callous crown with vestigial squamellae often apparent especially above the margins; chromosome number, $n = 34$.

Common in its restricted area of occurrence, especially along Meadow Valley Wash in SE Nevada. Fig. 5. Spring-Fall.

Representative specimens:

NEVADA: Lincoln Co. Railroad Canyon, 3 mi NE of Panaca, *D. H. Galway 8263* (US, UT); Caliente, *M. E. Jones s.n.* (POM); Panaca, *M. E. Jones s.n.* (CAS, DS, GH, POM, RM); Meadow Valley Wash along Hwy 93, 0.5 mi N of Caliente, *A. M. Powell* and *B. Calvert 1272* (SRSC); 0.5 mi N of Caliente, *Powell* and *D. Patterson 1626* (SRSC); 20 mi S of Caliente, S end of Rainbow Canyon on road to Elgin, Meadow Valley Wash, *P. Train 2453* (DS, NY,

UC).

Like several other species of sect. *Laphamia*, *P. gracilis* remains poorly understood biologically. Herbarium specimens indicate considerable variation in leaf and flowering head morphology. A single population of this species from near Caliente, Nevada, has been observed in the field (*Powell and Calvert 1272*), and its morphology does not correspond entirely with that of specimens from other localities, including the types. Plants from the Caliente population have larger leaves, stouter stems, larger heads, and involucral bracts which are connate at the base, as compared to plants from other areas. An explanation of this morphological disparity might be associated with the tetraploid chromosome number ($n=34$) which has been determined for plants from the Caliente population. Chromosomal information for plants from other areas is not available. Infraspecific polyploidy is frequent in *Perityle* species (Powell, 1968b), and it is not uncommon to find some gigas features associated with an increase in ploidy level. There is a need for further investigation in order to ascertain whether or not *P. gracilis* is also comprised of diploids.

The interspecific relationship of *P. gracilis* is not clear, but most morphological and chromosomal evidence suggests an affinity with *P. stansburii*. Considering especially the southern most populations of *P. stansburii*, the two taxa are not very different in total morphology, except that the leaves of *P. gracilis* are typically tripartite and the heads are discoid. The leaves of some specimens of *P. stansburii* show a strong tendency toward being trilobed.

There is some indication that *P. gracilis* is related to *P. congesta*, and thus a question arises about evolutionary sequence in the derivation of *P. gracilis*. The similar total morphology of *P. congesta*, especially the trilobed leaves, is suggestive of kinship. Additionally, the type collection of *P. gracilis*, which was near the original collection of *P. congesta* (Fig. 5), has enhanced the possibility of a relationship between the two taxa. A careful review of most evidence which has been compiled for both species has failed to verify any close affinity, although the location of the Jones collection of *P. gracilis* remains an intriguing anomaly. Chromosomal information appears to substantiate the derivation of *P. gracilis* ($n=34$) from *P. stansburii* ($n=17$), rather than from *P. congesta* ($n=16$). It follows then that *Perityle congesta* (and *P. tenella;* $n=16$, $n=32$) could have evolved from diploid *P. gracilis* by reduction in chromosome number, and thus reflect derived instead of ancestral morphological similarities. It must be emphasized, however, that any reliance on chromosomal data is at best tenuous because so little data of this sort are available for the species.

6. PERITYLE INYOENSIS (Ferris) Powell, Sida 3:278. 1968.

   Laphamia inyoensis Ferris, Contrib. Dudley Herb. 5:104. 1958. TYPE: CALIFORNIA: Inyo Co. in rocks facing NE across divide above Cerro Gordo mines, Cerro Gordo Peak, 8200 ft, 7 July 1942, *Alexander and Kellogg 3056A* (Holotype, DS! Isotype CAS! GH! LL! NY! POM! RM! UC!).

Plants 12-25 cm high, in dense, leafy clumps, pilose-villous; leaves opposite or alternate, 0.8-1.8 (2.1) cm long, 0.6-1.2 (1.5) cm wide, pilose-villous intermixed with short glandular hairs, ovate to broadly so, occasionally somewhat ovate-orbicular or ovate-deltoid, margins serrate-lobed, lobes and apex acute to subacute; petioles 0.5-2.0 (5.0) mm long; capitulescence of solitary heads or small clusters of 2-3; peduncles usually 0.8-4.0 cm long; involucres campanulate, heads 7.0-8.5 (9.0) mm long, 5-7 (8) mm wide; receptacle convex and rounded, 1.5-2.0 mm wide, ca. 1.0 mm high; involucral bracts 14-21, 5.5-6.5 mm long, 1.1-1.5 mm wide, sublanceolate to linear-lanceolate, keeled; ray flowers absent; disc flowers 35-60, corollas yellow, 4-5 mm long, the tube 1.4-1.6 mm long, the throat subtubular to subfunnelform, 2.0-2.4 mm long, the lobes acute, 0.6-0.7 mm long; style branches 2.0-2.3 mm long; achenes (2.5) 3.0-3.3 (3.5) mm long, narrowly obconical to suboblanceolate, rounded or angled on one surface, occasionally both, with thin callous margins, pubescent on the margins and both surfaces; pappus absent except for an inconspicuous callous crown, rarely with conspicuous, vestigial, squamellae, especially evident above the achene margins; chromosome number, $n = $ ca. 18.

A rare endemic apparently restricted to higher altitudes, 5900-8500 ft, in S Inyo Mts. of California. Fig. 5. Spring-Fall.

Specimens examined:

CALIFORNIA: Inyo Co. N slope of Cerro Gordo Peak, E of divide Inyo Mts., *A. M. Alexander and T. Kellogg 3056* (DS, GH, LL, NY, RM, US); 2 mi S of Cerro Gordo Spring, Inyo Mts., *M. D. Decker 746* (CAS, DS, RSA); Talc Canyon, Southern Inyo Mts., *E. C. Jaeger s.n.* (POM); ¼ mi N of Cerro Gordo Mine, E of ridge near road, Inyo Mts., *M. Kerr s.n.* (CAS, RSA); NE of Cerro Gordo Mines, *A. M. Powell and B. Calvert 1275* (SRSC).

Because of the several Laphamian taxa which occur in the mountains of southeastern California (Fig. 5), it is possible that the area was a major center of speciation. *Perityle inyoensis* appears to be restricted to relatively high altitudes (5900-8500 ft.) on or near Cerro Gordo Peak. The latter species is manifestly allied to *P. megalocephala* which is more widely distributed to the north and east at intermediate and lower altitudes. *Perityle villosa*, which is poorly distinguished from *P. inyoensis*, is known only from the type locality at 6500-7000 ft. in Hanaupah Canyon. In addition, a collection from Surprise Canyon (*Howell 3906*) appears anomalous among the other taxa. Ferris (1958) remarked about its similarity to *P. congesta* of Arizona, but in the present treatment it has been placed with *P. megalocephala* var. *oligophylla*. Perhaps much of the taxonomic uncertainty surrounding the California taxa could be removed through an extensive field survey in the areas concerned, but this will be extremely difficult because of the inaccessibility of habitats and limited flowering period.

Perityle inyoensis can be distinguished from *P. megalocephala* by its smaller habit, pilose-villous pubescence, essentially opposite leaves which are ovate to ovate-deltoid with serrate-lobed margins, and short petioles.

Peritule inyoensis is poorly delimited from *P. villosa*, except that the latter species has leaves which are entire or with 1-3 short lobes per margin.

7. PERITYLE VILLOSA (Blake) Shinners, Southwest. Nat. 4:205. 1959.

Laphamia villosa Blake, Proc. Biol. Soc. Washington 45:142. 1932. TYPE: CALIFORNIA: Inyo Co. in shaded rock crevices, middle fork of Hanaupah Canyon, Panamint Mts., 2090 m, 22 Sept 1931, *F. V. Coville and A. F. Gilman 108* (Holotype, US! Isotype, US! Photograph, DS!).

Plants 13-20 cm high, villous; leaves alternate, 1.2-2.2 cm long, 0.4-1.0 cm wide, villous, ovate to ovate-cuneate and entire or ovate-cuneate and lobed, with 1-3 short, pointed lobes on each margin, acute or cuneate at the base, acute at the apex; petioles 3-6 mm long; capitulescence of solitary heads or small clusters of 2-3; peduncles 1-2 (2.5) cm long; involucres campanulate, heads 7.5-9.5 mm long, 5-7 mm wide; receptacle flattened to slightly convex, 1.3-2.5 mm wide; involucral bracts 13-23, ca. 6.0 mm long, 1.0-1.5 mm wide, oblong-lanceolate to linear-lanceolate, inconspicuously keeled; ray flowers absent; disc flowers 30-75, corollas yellow, 4-5 mm long, the tube 1.0-1.7 mm long, the throat subfunnelform to tubular, 1.8-3.0 mm long, the lobes acute, 0.7-0.8 mm long; style branches 1.8-2.5 mm long; achenes 3.0-3.5 mm long, linear to oblong-obconical, typically rounded on both surfaces, with callous margins, short-pubescent on the margins and both surfaces; pappus absent, except for a conspicuous to inconspicuous callous crown, or in some heads of 1-2 bristles of equal or unequal length, 1-2 mm long; chromosome number, $n = 10\text{-}22$ II plus 3-19 I.

Known only from the type locality. Fig. 5. Spring-Fall.

Representative specimens:

CALIFORNIA: Inyo Co. Hanaupah Canyon, Panamint Mts., *F. V. Coville and A. F. Gilman 109* (US); middle fork of Hanaupah Canyon, Panamint Mts., Death Valley Nat'l Mon., *S. Sikes 100* (SRSC).

The complexity of *P. villosa* has been magnified through examination of a recent collection (*Sikes 100*). Leaves of the type specimens are essentially entire, while different plants from the Sikes collection have leaves which are either entire or short-lobed. In addition, plants with opposing leaf forms also exhibit independently several other differing features, thus suggesting the side-by-side occurrence of two morphotypes at the Hanaupah Canyon locality. The Sikes specimens with entire leaves conform to the type specimens except that in a few heads of some individuals, achenes with a pappus of 1-2 awns are found. The plants with lobed leaves also differ by producing larger heads, wider receptacles, more bracts, longer disc corollas, and longer, tubular throats. In fact, the "lobed" and "entire" forms are sufficiently different, that if they occurred in separate localities, they probably would be recognized as separate taxa.

There is some evidence which indicates that the two morphotypes of *P. villosa*, and accompanying variability, has resulted from the occurrence of diploids, tetraploids, and triploidy, in the population. Meiosis observed in "greenhouse buds" from a lobed-type plant revealed extremely abnormal

configurations of $n=10$-22 II and 3-19 I. This cytological information suggests triploidy on the expected basis of $n=17$ II + 17 I, and, pending further study, at least provides a possible explanation for the complexity observed in *P. villosa*.

8. PERITYLE TENELLA (Jones) Macbride, Contrib. Gray Herb. n.s. 56:39. 1918.

Laphamia palmeri A. Gray, Proc. Amer. Acad. 13:372-373. 1878. TYPE: ARIZONA: at Beaverdam, growing in crevices of rock in canyons, 1877, *E. Palmer 199* (Holotype, GH! Isotypes, ND! NY! US!).

Laphamia palmeri var. *tenella* M. E. Jones, Proc. Calif. Acad. II. 5:703. 1895. TYPE: UTAH: Springdale, in crevices of sandstone rocks, 4000 ft., 16 May 1894, *M. E. Jones 5249aa* (Holotype, POM! Isotype, US!).

Laphamia tenella M. E. Jones, Proc. Calif. Acad. II. 5:703. 1895.

Monothrix palmeri (A. Gray) Rydb. N. Amer. Fl. 34:21. 1914.

Plants 15-25 cm high, densely to sparsely short pilose-hirsute, densely leafy; leaves alternate, 1.0-2-3 cm long, 0.8-1.8 cm wide, sparsely to densely short pilose-hirsute, typically broadly deltoid-ovate, less often broadly subovate to subcordate, the margins regularly to irregularly serrate or dissected into acute, shallow lobes; petioles 2.0-8.0 mm long; capitulescence of solitary heads or small clusters; peduncles usually 0.4-2.5 cm long; involucres campanulate, heads 6-7 mm long, 4-6 mm wide; receptacle flattened, 1.5-1.8 mm wide; involucral bracts ca. 13, 4.0-4.5 mm long, 1.1-1.3 mm wide, lanceolate-elliptic, inconspicuously keeled; ray flowers absent; disc flowers 23-35, corollas yellow, 3.0-4.0 mm long, the tube 1.2-1.6 mm long, the throat subtubular to narrowly funnelform, 1.2-1.6 mm long, the lobes acute, 0.6-0.7 mm long; style branches 1.0-1.8 mm long; achenes 2.5-3.0 mm long, very narrowly obconical, rounded or obscurely angled on one or both surfaces, with thin callous margins, short pubescent on the margins and both surfaces; pappus of a single bristle, 2.0-2.6 mm long; chromosome number, $n=16$.

Crevices of rock bluffs in protected canyons, usually at lower altitudes, extreme SW Utah and NW Arizona. Fig. 5. Spring-Fall.

Representative specimens:

ARIZONA: Mohave Co. Burnt Canyon, *W. P. Cottam s.n.* (UT); 4 mi E of Beaverdam, *A. M. Powell and S. Sikes 1386* (SRSC); 5.7 mi S of Jacobs Well, E base of Virgin Mts., *P. H. Raven and D. Verity 15483* (RSA, UC). NEVADA: Clark Co. 2nd canyon S of Limestone Point, Virgin Mts., *P. A. Munz 16709* (DS). UTAH: Washington Co. Great Arch Trail, E of tunnel, Zion Nat'l Park, *S. Braem 852* (DS); Zion Nat'l Park, *Cottam 3442* (UT): St. George, *Cottam 7244* (UT); near observation point, Zion Nat'l Park, *O. Degener and L. Peiler 16544* (NY); Zion Nat'l Park, *A. Eastwood and J. T. Howell 1161* (CAS, NY); Clear Creek, Zion Park, *Eastwood and Howell 6330* (CAS); Hurricane, *Eggleston 14863* (US); Zion Canyon, *A. D. Garrett 2958* (NY); Zion Canyon, *M. E. Jones s.n.* (POM); ½ mi-¼ mi up E Rim Trail, Zion Canyon, Zion Nat'l Park, *Powell and Calvert 1267* (SRSC); Zion Canyon along E. Rim Trail, *Powell and D. Patterson 1627* (SRSC); Clear Creek

Canyon, Zion Park, *H. D. Ripley and R. C. Barneby 4930* (CAS, NY); E Rim Trail, Zion Canyon, Zion Nat'l Park, *K. E. Weights 964-A-Z* (UT); Narrows Trail, Zion Canyon, *Weights s.n.* (UT); Zion Nat'l Park, *A. M. Woodbury 21* (US).

Although *Laphamia palmeri* A. Gray is an older name, that specific epithet was preempted when *Laphamia* was transferred to *Perityle* (Shinners, 1959; Powell, 1968a). According to M. E. Jones' Journal of Botanical Exploration (Howell and Munz, 1965), his specimens of *P. tenella (5249aa)* were collected in Zion Canyon above Springdale, Utah.

Perityle tenella is best distinguished from the closely related *P. congesta* by its broadly deltoid-ovate leaves with margins which are regularly to irregularly serrate or dissected into acute, normally further serrated lobes. No differences worthy of varietal status were detected between Utah and Arizona populations.

There is a striking similarity in the habits of *P. tenella* ($n=16$) and *P. castillonii* ($n=17$) of Chihuahua and Coahuila, Mexico, but their extreme geographic separation would appear to negate any consideration that the two taxa are closely related. Besides their chromosome numbers, the two species differ in but a few technical features.

9. PERITYLE CONGESTA (M. E. Jones) Shinners, Southwest. Nat. 4:204. 1959.

Laphamia congesta M. E. Jones, Proc. Calif. Acad. Sci. 5:703. 1895. TYPE: ARIZONA: in clefts of rocks on the mesa below the Buckskin Mts., 7000 ft., 21 Sept 1894, *M. E. Jones 6063* (Holotype, POM! Isotypes, NY! POM! RM! UC! US! Photograph DS!).

Laphamia toumeyi Rob. and Greenm., Amer. Journ. Sci. 50:176. 1895. TYPE: ARIZONA: in the Grand Canyon, 12 July 1892, *J. W. Toumey 645* (Holotype, US! Isotypes, DS! GH! Photographs DS!).

Monothrix congesta (M. E. Jones) Rydb. N. Amer. Fl. 34:20. 1914.

Monothrix toumeyi (Rob. and Greenm.) Rydb. N. Amer. Fl. 34:20. 1914.

Plants 10-30 cm high, densely clumped and leafy, hirtellous; leaves alternate, rarely opposite, 1.0-2.5 cm long, 0.4-0.8 cm wide, hirtellous, typically ovate and 3-lobed, but often ovate-lanceolate to ovate-elliptic and 3-lobed rarely 4-5 lobed, serrate, or entire, rounded or obtuse at the apex; petioles 2.5-10 (14) mm long; capitulescence subcymose, of small clusters, or less often of solitary heads; peduncles usually 0.3-1.7 cm long; involucres campanulate, heads 5.0-6.0 (6.5) mm long, 3.5-4.5 (5.0) mm wide; receptacle convex, typically rather flattened, less often slightly rounded, 1-2 mm wide; involucral bracts 13-16, 3.5-4.5 mm long, 0.8-1.4 mm wide, oblong-lanceolate to sub-lanceloate, rather flattened to keeled; ray flowers absent; disc flowers 30-40, corollas yellow, 2.5-3.0 mm long, the tube 0.8-1.0 mm long, the throat tubular to subfunnelform, 1.2-1.5 mm long, the lobes acute, 0.3-0.5 mm long, style branches 1.2-1.5 mm long; achenes (2.0) 2.5-3.0 mm long, narrowly obconical, rounded or angled on one or both surfaces, with thin callous margins, very short pubescent on the margins, slightly pubescent on both surfaces; pappus of 1-2 subequal to very unequal bristles, the longest 2.0-2.7

mm long, and an obscure crown of hyaline squamellae; chromosome number, $n=16$.

Common in rock bluffs along the high rims of the Grand Canyon, Arizona, and vicinity. Fig. 5. Spring-Fall.

Representative specimens:

ARIZONA: Coconino Co. Grand Canyon, *M. Armstrong 216* (NY); Havasupai Canyon, *E. U. Clover 5008* (LL); near the top of Hualpai Trail, *Clover 7152* (LL); North Rim, Grand Canyon, *R. E. Collom s.n.* (US); North Rim, Grand Canyon, *Collom 1116* (US); Jumpup Ranger Station, Kaibab Plateau, Kaibab Nat'l Forest, *R. A. Darrow 2982* (CAS); Hualpai Hilltop, Kaibab Nat'l Forest, *Darrow 3130* (CAS); Havasu Canyon, *C. F. Deaver 1487* (CAS); Bright Angel Trail, Grand Canyon Ariz., *A. Eastwood 22* (US); Grand Canyon, *Eastwood 3606a* (CAS, GH); Grand Canyon, *Eastwood 3506* (CAS); Hermit Trail, *Eastwood 5817* (CAS); Grand Canyon, Kaibab Trail to Roaring Springs, *Eastwood and J. T. Howell 1013* (CAS, POM); Kaibab Trail to Roaring Springs in Grand Canyon Nat'l Park, *Eastwood and Howell 1021* (CAS); North Rim of Grand Canyon, *Eastwood and Howell 7038* (CAS); Kaibab Trail to Roaring Springs, Grand Canyon, *Eastwood and Howell 7059* (CAS, GH, US); N slope of Willow Point, *L. N. Goodding 279-48* (UC); Oak Canyon, Kaibab Plateau, *Goodding 425-48* (UC); Jumpup Canyon, Kaibab Plateau, *Goodding s.n.* (CAS); trail into Grand Canyon, *A. E. Hitchcock 84* (US); head of Hualpai Canyon, Grand Canyon Nat'l Park, *Howell 26369* (CAS, RSA); Hualpai Canyon, Grand Canyon Nat'l Park, *Howell 26381* (CAS NY, UC); Havasu Canyon, Grand Canyon Nat'l Park, *Howell 26441* (CAS, RM, SMU); Bright Angel Canyon, Grand Canyon, *F. W. Hunnewell 10898* (GH); Grand Canyon, *F. R. Irvine s.n.* (DS); Peach Springs, *Jones s.n.* (POM); Bright Angel, Grand Canyon, *Jones s.n.* (DS, POM); Bright Angel Trail to Grand Canyon, *J. B. Leiberg 5954* (US); Bright Angel Trail, Grand Canyon, *G. E. Osterhout 6980* (RM); Cape Royal, Kaibab Nat'l Forest, *F. W. Peirson 7419* (CAS, POM, RSA); head of Bright Angel Trail, Grand Canyon Nat'l Park, *A. M. Powell 1264* (SRSC); Mather Point, South Rim of Grand Canyon, *Powell and B. Calvert 1265* (SRSC); Bright Angel Point, North Rim, Grand Canyon Nat'l Park, *Powell 1266* (SRSC); Grand Canyon, *C. A. Purpus 8307* (UC, US); Grand Canyon, *V. Rattan s.n.* (UC); Kaibab Trail, Grand Canyon Nat'l Park, *P. H. Raven 13118* (CAS, DS, NY); top of Mooney Falls, Havasu Canyon, *M. Sutton 8* (CAS); Grand Canyon, *J. W. Toumey 645* (DS, GH, US). Mohave Co. Tuweep, at canyon rim, *W. P. Cottam 8613* (UT); outer gorge, Toroweap, *Cottam 13319* (CAS, UT); Saddle Horse Canyon, Grand Canyon Nat'l Park, *Cottam 13535a* (SMU, UT); Big Cove, Outer Gorge, Grand Canyon Nat'l Monu., Toroweap, *Cottam 13622* (UT). Yavapai Co. Grand Canyon, *E. D. Wooton 389* (US).

Peritule congesta is a slightly variable species which occurs mainly around the upper rims of the Grand Canyon of Arizona. Morphologically the taxon is poorly delimited from *P. tenella* which occurs just to the northwest in Arizona and Utah. Perhaps the only character which can be used

consistently to distinguish *P. congesta* from *P. tenella* is the usually smaller leaves which are typically ovate and 3-lobed, but often ovate-lanceolate to ovate-elliptic and 3-5 lobed, serrate, or entire. Chromatographic patterns obtained for the two species are not noticeably different.

The basic chromosome number of $x=16$ for *P. congesta* and *P. tenella* set the taxa apart from all others in sect. *Laphamia* (Powell, 1968b). Their relationship to other Laphamian species is not clear, but most evidence suggests affinity with *P. gracilis* ($n=34$) of the "southwestern alliance." Geograpically, the ranges of *P. congesta* and *P. tenella* are close to *P. gracilis*. In this genus, because of previously explained evolutionary tendencies, adjacent species are usually related. There is no compelling morphological indication of relationship with *P. gracilis*, but the three taxa are similar in general habit and floral structure. The chromatographic patterns of *P. congesta* and *P. tenella* are most like that of *P. gracilis* and thus, this chemical character might be indicative of a true relationship which has remained rather obscure on other grounds.

It is interesting to note that both *P. congesta* (*Jones 6063*) and *P. gracilis* (*Jones 6050c*) were collected on or near the Buckskin Mts. of Arizona, which are located near the western edge of the Kaibab Plateau south of Fredonia (Howell and Munz, 1965). Jones' Arizona collection of *P. gracilis* is out-of-place with all other records for the species.

There is some indication that *P. congesta* is allied with *P. megalocephala* var. *oligophylla* of southeastern California as suggested by Ferris (1958). One collection of *P. megalocephala* var. *oligophylla* from Surprise Canyon in the Panamint Mts. near Death Valley (*Howell 2906*) is rather anomalous among the California taxa of sect. *Laphamia*, but closely resembles *P. congesta*. Any close relationship of *P. congesta* to the California species appears tenuous because of the present geographical gap, but it is suggested that they have ancestral affinity through a common ancestor of the southwestern alliance.

10. PERITYLE SAXICOLA (Eastwood) Shinners, Southwest. Nat. 4:204-209. 1959.

    Laphamia saxicola Eastwood, Proc. Calif. Acad, Sci. IV, 20:159-160. TYPE: ARIZONA: Maricopa Co. near the Roosevelt Dam on the road to Fish Creek, Apache Trail, 22 May 1929, *A. Eastwood 17401* (Holotype, CAS! Isotypes, CAS! DS! GH! POM! UC! US!).

Plants 20-40 cm high, spreading in clumps to ca. 30 cm wide, leafy to the tops, essentially glabrous except the peduncles glandular-puberulent; leaves opposite below, inconspicuously alternate above, 3.0-8.5 cm long, glabrous, typically tripinnate, less often bipinnate, the segments long, linear, to flat-filiform; petioles 1.0-3.0 cm long, scarcely wider than the leaf segments; capitulescence of solitary heads or 2-3 in loose clusters; peduncles 1-3 cm long; involucres broadly campanulate to hemispheric, heads 7.5-10 mm high, 10-14 mm wide, mostly extending above upper leaves; receptacle convex, slightly rounded, 2-3 mm wide; involucre appearing uniseriate, bracts ca.

25, (7.5) 5-7 mm long, ca. 0.9 mm wide, linear-lanceolate, keeled; flowers ca. 100-200; ray flowers ca. 12-17, pistillate and fertile, the tube 2-3 mm long, ligules yellow, 4-6 mm long, 2.0-3.2 mm wide, oblong to oblong-ovate, trilobed at the apex; disc corollas yellow (4.0) 5.0-6.5 mm long, the tube (1.5) 1.7-2.0 mm long, the throat tubular to narrowly funnelform, the lobes acute, 0.5-0.6 mm long; style branches ca. 1.8 mm long; achenes 2.8-3.2 mm long, oblong-obconical to narrowly obconical, with conspicuous callous margins, short-pubescent on the margins especially and both surfaces; pappus of a single bristle, 4-5 mm long, rarely reduced to ca. 2.0 mm; chromosome number, $n=17$.

Locally frequent but otherwise rare, growing in igneous rocks near the type locality, and Tonto National Monument. Fig. 3. Spring-Fall.
Representative specimens:

ARIZONA: Gila Co. E of entrance to Tonto Nat'l Monument, *A. M. Powell 1262* (SRSC). Maricopa Co. rocks near Roosevelt Dam, *A. Eastwood 8695* (CAS); Roosevelt Dam, *R. H. Peebles 9420* (DS, US), ½ mi below Roosevelt Dam, *S. Sikes 97* (SRSC).

The endemic *P. saxicola* (n=17) is clearly related to *P. gilensis* (*n*=ca. 17, 34-36). *Perityle saxicola* is easily distinguished by its thrice- to bi-pinnately dissected leaves which have linear segments, but otherwise the two species are morphologically similar.

11. PERITYLE GILENSIS (Jones) Macbride

KEY TO THE VARIETIES

1a. Petioles 0.9-1.8 cm long . . . . . 11a. var. *gilensis*.
1b. Petioles 2.5-4.5(8.0) cm long . . . . . 11b. var. *salensis*.

11a. PERITYLE GILENSIS (Jones) Macbride var. GILENSIS, Contrib. Gray Herb. n.s. 56:39. 1918.

Laphamia gilensis Jones, Zoe 2:15. 1891. TYPE: ARIZONA: growing among rocks, at Putnam's Ranch, near the Gila River, 23 May 1890, *M. E. Jones s.n.* (Holotype, POM! Isotypes, UC! US!).

Leptopharynx gilensis Rydb., N. Amer. Fl. 34:24. 1914.

Laphamia arizonica Eastw., Proc. Calif. Acad. IV 20:159. 1931. TYPE: ARIZONA: Maricopa Co. Fish Creek, Apache Trail, 18 May 1919, *A. Eastwood 8753* (Holotype, CAS!).

Laphamia dura A. Nels., Amer. Bot. 23:266. 1936. TYPE: ARIZONA: Maricopa Co. Salt River Valley, near Canyon Lake, 3 May 1925, *A. Nelson 10323* (Holotype, RM! Isotype, DS! Photograph US!).

Plants 22-40 cm high, often spreading to ca. 40 cm in dense clumps, essentially glabrous, appearing scarcely leaved except near the base; leaves essentially opposite, rarely alternate distally, basal leaves 1.4-3.0 cm long, 0.4-1.0 (2.0) cm wide, becoming progressively smaller upwards, essentially glabrous to sparsely puberulent, typically pinnately trifoliate with the segments very broadened distally, often cruciform in appearance, less often merely trilobed to divided, terminal segment entire to lobed; petioles 0.9-1.8 cm long; capitulescence of solitary heads or groups of 2-4 on rather stout

peduncles; the peduncles usually 1.0-3.5 cm long; involucres broadly campanulate to hemispheric, heads 8-11 mm long, 9-12 mm wide, very conspicuous above the sparsely leafed stems; receptacle convex, rounded, or flattened, (2.0) 2.5-4.5 mm wide, 0.8-1.2 mm high; involucral bracts 25-30, 5-7 mm long, 0.8-1.5 mm wide, sublanceolate to oblanceolate, attenuate, keeled; flowers ca. 100-200; ray flowers ca. 10, pistillate and fertile, the tube ca. 2.0 mm long, ligules yellow, 5.0-7.0 mm long, 2.0-3.8 mm wide, oblong to subovate, tridentate at the apex; disc corollas yellow, (4.5) 5.0-6.5 mm long, the tube (1.0) 1.5-2.0 mm long, the throat subtubular to narrowly funnelform, 2.5-3.5 mm long, the lobes acute, 0.7-0.8 mm long; style branches (2.0) 2.5-3.0 mm long; achenes 2.6-3.4 mm long, narrowly obconical or oblanceolate to narrowly obconical-elliptic, usually rounded on one surface and flattened on the other, with conspicuous callous margins, short-pubescent on the margins especially and both surfaces; pappus of a single bristle (rarely 2-3) 3.5-4.6 mm long, and a rather obscure crown of hyaline squamellae; chromosome number, $n = 34$-36.

Common in southeast-central Arizona, in crevices of igneous bluffs and boulders particularly along canyon walls, sometimes found growing at the base of boulders, seemingly in soil, but probably always rooted in subterranean crevices. Fig. 3. Spring-Fall.

Rerpresentative specimens:

ARIZONA: Gila Co. San Carlos Indian Reservation, vicinity of Blue River Crossing, U.S. Hwy 60, *B. Maguire 13070* (NY). Maricopa Co. Horse-Mesa Dam, along Apache Trail, *A. Eastwood 17375* (CAS, GH, POM, US); Fish Creek Canyon, *T. H. Kearney and R. H. Peebles 14490* (US); Fish Creek Hill, *Kearney and Peebles 15133* (CAS, SMU); Fish Creek Canyon, *E. P. Killip 32723* (US); Apache Trail, near Fish Creek, *A. Nelson and R. A. Nelson 1772* (NY, RM, UC); Fish Creek, *Peebles, G. J. Harrison, and Kearney 5247* (US); near Roosevelt Dam, Fish Creek, *Peebles and Harrison 5287* (US); crossing of Fish Creek and Hwy 88, Apache Trail, *A. M. Powell and B. Calvert 1263* (SRSC); Apache Trail near Tortilla Flat, *H. D. Ripley and R. C. Barneby 2830* (NY); top of Fish Creek Hill, Apache Trail, *S. Sikes 107* (SRSC). Pinal Co. along Queen Creek, Thompson Arboretum, near Superior, *E. H. Graham 3721* (DS); Queen Creek Canyon, *Kearney and Peebles 9224* (US); Devil's Canyon, *Peebles, Harrison, and Kearney 3183* (US); 4 mi NE of Superior, near Superior, near Hwy 60-70, *Powell and B. McAfee 1317* (SRSC); Thompson Arboretum grounds, near Superior, *J. Whitehead 2255* (RM).

11b. PERITYLE GILENSIS var. **salensis**[3] Powell, var. nov. Fig. 7. TYPE:

ARIZONA: Gila Co. Salt River Canyon between Globe and Show Low, 18 Aug 1969, *S. Sikes 428* (Holotype, SRSC! Isotypes, SMU! TEX!).

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[3] *Laphamia gilensis* subsp. *longilobus* Niles, Mem. N.Y. Bot. Gard. 21:51-54. 1970, is listed here as a synonym which appeared in print (Niles, 1970) after this work was accepted for publication.

Fig. 7. *Perityle gilensis* var. *salensis*: photograph of holotype (SRSC), *S. Sikes 428.*

Plantae 30-70 cm longae, pendulae vel decumbentes; folia glabra, (3.0)3.5—5.5(10.0) cm longa, superiora (raro basaliaque) ad filiformi-linearia vergentia vel apicem versus expansa (spathulata, lanceolata vel ovata), lobata vel integra, basalia et mediocria longipetiolata laminis latis vulgo trilobis ad subcruciformibus 1-2 cm longis 1.0-1.5 cm latis; petiolis 2.5—4.5(8.0) cm longis; flores sicut in var. *gilensi*, sed radii 8-12 ligulis 0.7-1.0 cm longis; chromosomata $n=$ca. 17.

Restricted to the Salt River Canyon, between Globe and Show Low, Arizona. Fig. 3. Spring-Fall.

Specimens examined:

ARIZONA: Gila Co. Salt River Canyon, Globe to Show Low, *R. A. Darrow* s.n. (CAS); Salt River Canyon, *Darrow* (CAS).

Few collections of *P. gilensis* var. *salensis* ($n=$ca. 17) have been examined, but its distinctiveness from var. *gilensis* ($n=34$-36) is clearly indicated by chromosome numbers, geographic separation (Fig. 3), and a few morphological characters. Variety *salensis* is most easily recognized by its robust, trailing habit and long-petioled leaves which are larger than those of var. *gilensis*. Plants of var. *salensis* with distinctive filiform-linear leaves (see description) are perhaps nothing more than ecological variants, judging from the ontogeny of several greenhouse cultures. The distal leaves of such individuals may be filiform-linear, but as the plants grow older, basal leaves develop the typical blade-like (trilobed) appearance. Greenhouse cultures also indicate that both varieties of *P. gilensis* maintain their typical morphologies when grown under uniform conditions.

Perityle gilensis var. *gilensis* has not been adequately sampled chromosomally. Geographical and morphological evidence would seem to indicate that var. *gilensis* originated from var. *salensis* via migration down the Salt River and through the establishment of autopolyploidy. The probability of autoploid origin should be substantiated if, as suspected, diploid populations of var. *gilensis* are also found within its range.

The once-pinnatifed tripartite leaves (with broad segments) exhibited by *P. gilensis* represent the most convenient feature for delimiting the taxon from *P. saxicola*. Distributional evidence (Fig. 3) and leaf morphology suggest that *P. saxicola* ($n=17$) evolved from *P. gilensis* var. *salensis* as probably did var. *gilensis*.

The infrasectional position of *P. gilensis* and *P. saxicola* is still an open question. Their superficial morphology suggests the possibility that they were derived independently from a species of sect. *Perityle* somewhat like *P. vaseyi*. *Perityle gilensis* and *P. saxicola* do not exhibit any apparent morphological or chromatographical affinity to other radiate species of sect. *Laphamia*, with the possible exception of *P. staurophylla*.

12. PERITYLE LEMMONI (Gray) Macbride, Contrib. Gray Herb. n.s. 56:39. 1918.

Laphamia lemmoni Gray, Proc. Amer. Acad. 16:101. 1880. TYPE: ARIZONA: Pima Co. near Camp Lowell, Tucson, 1880, *Lemmon s.n.*

(Holotype, GH!).
Laphamia lemmoni var. *pedata* Gray, Proc. Amer. Acad. 16:101. 1880.
Leptopharynx lemmoni (Gray) Rydb. N. Amer. Fl. 34:24. 1914.

Plants 6-17 (23) cm high, densely clumped and leafy, densely pilose or pilose-hirsute so that plants often appear cinereous; leaves typically opposite, seldom alternate above, 1.0-1.9 (2.5) cm long, 0.7-1.5 cm wide, densely pilose or pilose-hirsute, ovate and irregularly laciniate-serrate or lobed, to clearly thrice divided and palmate, the 3 main segments irregularly laciniate-dissected (merely serrate-lobed in one population); petioles 3-5 (8) mm long; capitulescence of solitary heads or small clusters on rather short, stout peduncles (1-4 mm long); involucres campanulate; heads 7-10 mm long, 5-9 mm wide, partially obscured by leaves; receptacle convex, rounded, rarely flattened, 1.0-2.0 mm wide, ca 0.5 mm high; involucral bracts 11-14, 4.0-6.4 (8) mm long, 1.0-1.7 mm wide, oblong-lanceolate to linear-lanceolate, rather flattened, keeled or with a rather prominent midrib; ray flowers absent; disc flowers 22-35, corollas yellow, often purple tinged at maturity, 3.8-4.7 (5.0) mm long, the tube 1.0-1.9 mm long, the throat broadly tubular to narrowly funnelform, 2.0-2.5 (2.9) mm long, 0.7-1.0 mm wide, the lobes acute, 0.4-0.6 mm long; style branches 1.8-1.9 mm long; achenes 2.5-3.2 (3.6) mm long, oblong-obconical to narrowly obconical, rounded or angled on one or both surfaces, with thin callous margins, short-pubescent on the margins and both surfaces; pappus of a single, very slender, delicate bristle (rarely 0-2), (0.1) 2.0-3.0 (4.0) mm long, and a vestigial crown of hyaline squamellae, or the squamellae absent, the bristles of various lengths even in same head; chromosome number, $n=17$.

Common in crevices of granitic cliffs and boulders in SE Arizona. Fig. 8. Spring-Fall.

Representative specimens:

ARIZONA: Cochise Co. Douglas, rock crevices, *L. N. Goodding 2292* (UC); Outlaw Canyon, *Goodding 2371* (DS, RH, UC); Chiricahua Mts., *J. G. Lemmon s.n.* (UC, US). Graham Co. Frye Canyon, ½ mi above dam, Graham Mt., *B. J. Maguire and R. R. Maguire 11733* (NY); Marijilda Canyon, NE Graham Mt., *Maguire and Maguire 12067.* Greenlee Co. Sandstone rocks, Clifton, Frisco River, *A. Davidson 341* (DS, NY, UC); Clifton, *Davidson 341a* (ND); cliff above San Francisco River bank, S Clifton, *Maguire, B. L. Richards, and T. Mueller 11787* (GH, NY, UC, US). Pima Co. Sabino Creek, Sabino Canyon, *L. Benson 9828* (POM); Soldier Trail Hwy., Santa Catalina Mts., *Benson 11401* (POM); Santa Catalina Mts., W of Sabino, *E. B. Bartram 427* (US); Sabino Canyon, Tucson, *W. P. Cottam 10128* (UT); hills above Colossal Cave, *A. Eastwood, s.n.* (CAS); Colossal Cave near barbecue area, *F. W. Gould and R. A. Darrow 2642* (LL, NY); Santa Catalina Mts., *Gould 3440* (CAS, LL, NY, UC); Sabino Canyon, *D. Griffiths 2575* (NY); near Tucson, *J. G. Harrison 7184* (US); Santa Catalina Mts., *Lemmon s.n.* (DS, UC); Camp Lowell, *W. F. Parish 90* (DS); near Hitchcock Rd. to Mt. Lemmon, 1 mi below Molino Basin, *A. M. Powell and B. Calvert 1260* (SRSC);

Santa Catalina Mts., Windy Vista Point, *Powell and Calvert 1261* (SRSC); Santa Catalina Mts., *C. G. Pringle s.n.* (DS, NY, US); Santa Rita Mts., *Pringle s.n.* (NY); Santa Catalina Mts., *Pringle s.n.* (NY); Goose-head rock, Mt. Lemmon, *S. Sikes 96* (SRSC). NEW MEXICO: Hidalgo Co. limestone cliffs at NE end of Big Hatchet Mts., *T. K. Todsen 2001* (SRSC).

This species has been merged with *P. dissecta*, or interpreted as subspecific with the latter taxon by several taxonomists including Everly (1947) and Niles (1970). However, several factors support the recognition of *P. lemmoni* as a distinct species, and in fact suggest a closer relationship with *P. castillonii* than with *P. dissecta*.

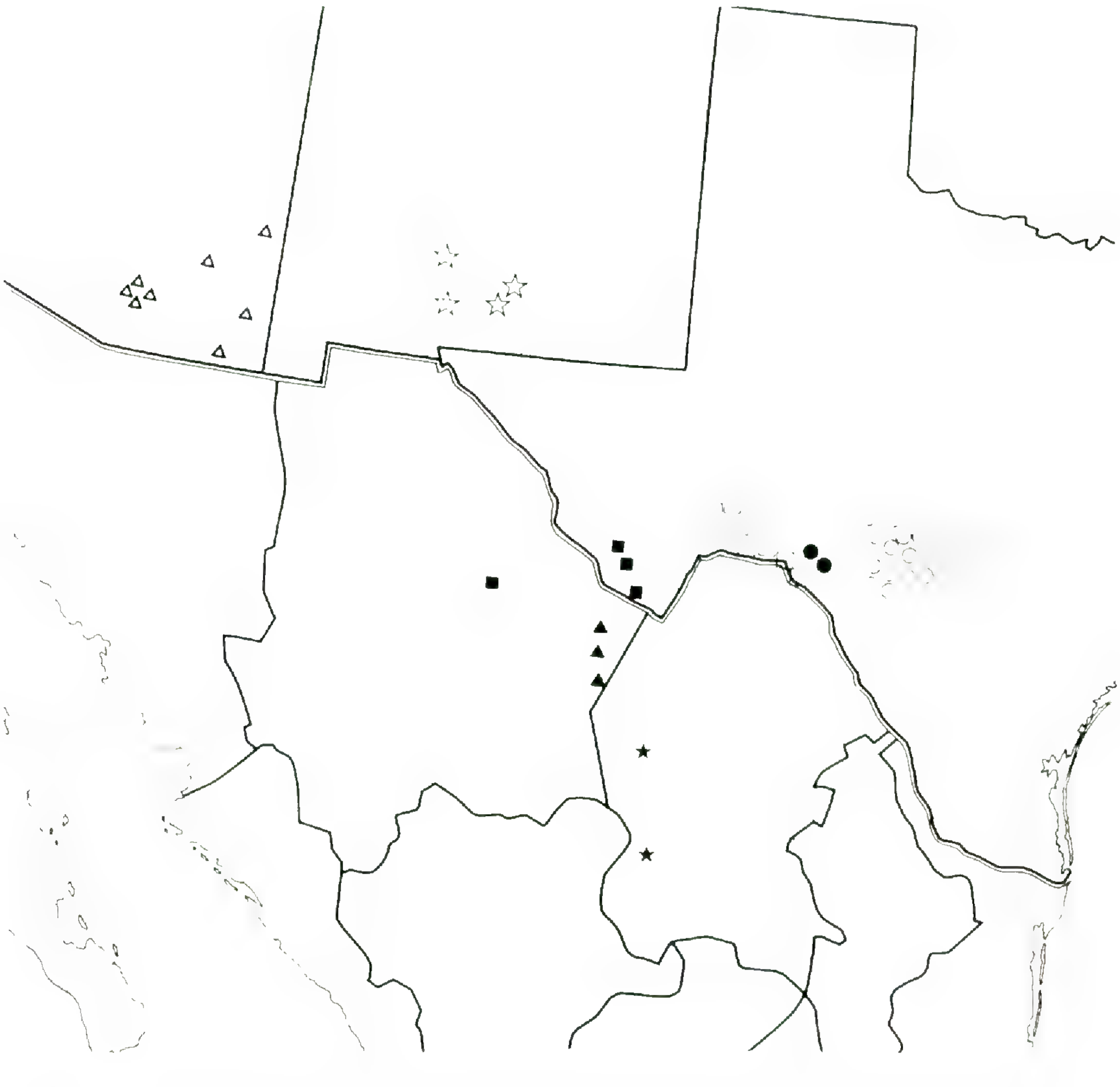

Fig. 8. Distribution of *P. lindheimeri* var. *lindheimeri* (open circles); *P. lindheimeri* var. *halimifolia* (closed circles); *P. angustifolia* (open squares); *P. dissecta* (closed squares); *P. castillonii* (closed triangles); *P. stauro-phylla* (open stars); *P. coahuilensis* (black stars); *P. lemmoni* (open triangles).

Unquestionably a similarity in gross leaf morphology has led to most opinions that *P. lemmoni* and *P. dissecta* are conspecific. The leaves of both taxa are indeed dissected, but there are differences in these structures. Essentially, in *P. lemmoni*, the leaf lobes and segments are usually broader than in *P. dissecta* and are densely pilose. As compared to *P. dissecta*, other distinguishing features of *P. lemmoni* include; shorter, broader, acute bracts which are pilose, broad-tubular to subfunnelform disc corollas, slender, delicate pappus bristles, and granite (or conglomerate) habitat. In view of these differences, and the distinct distribution of *P. lemmoni* (Fig. 8), I would suspect similarity to *P. dissecta* through convergence if chromatographic pattern data did not indicate a relationship to *P. dissecta* and *P. castillonii*.

Perityle lemmoni differs from *P. castillonii* most conspicuously in leaf morphology. The two taxa generally compare, however, in dense pubescence (including broader trichomes), shape of disc corollas, slender pappus bristles, and shape of involucral bracts.

A closer relationship between *P. lemmoni* and *P. castillonii* is not supported by chromatographic pattern data. The patterns of *P. castillonii* and *P. dissecta* are much more similar to each other than to *P. lemmoni*. In spite of the bulk of morphological evidence suggesting a closer affinity of *P. lemmoni* and *P. castillonii*, further sampling of intermediate populations, if they exist, will be necessary before arriving at a confident appraisal of true relationships among this related-species group.

Two "atypical" collections which have been referred to *P. lemmoni* add to the populational complexity of the taxon. The atypical populations occur near the summit of Graham Mt. in Graham Co., Ariz. (e.g., *Maguire and Maguire 11733*), and near Clifton, Ariz. (e.g., *Davidson 341*). Specimens of the Graham Mt. collection show leaves which are ovate-deltoid in outline and are irregularly serrate-lobed to cleft or divided, but tend to be less lobed and dissected than typical *P. lemmoni*. These plants also have larger heads than other *P. lemmoni*, and produce a more conspicuous crown of pappus squamellae. Considering leaf morphology especially, it is possible to construe the Graham Mt. population as approaching the expected ancestral form of the species.

According to label information on herbarium sheets, the Clifton population (*Davidson 341a, 341*) was proposed as a new species, *Laphamia ambrosaefolia*, by Greene. This name is not listed in the synonymy because I can find no record of it having been published. Plants from the Clifton population resemble *P. dissecta* in leaf, involucral bract, and pappus morphology (stout bristles) more than any other specimens of *P. lemmoni*. Perhaps most interesting about the Clifton population is the occurrence of ray florets with well formed ligules up to 4.0 mm in some heads of the NY and UC specimens. *Perityle lemmoni* is otherwise entirely discoid. The presence of ray florets, and total morphology, suggests the possibility that *P. lemmoni* (at least the Clifton population) has hybrid origin, with the generally sympatric

P. coronopifolia (sect. *Perityle*) as one parent. In experimental crosses between other radiate X discoid species, ray floret dominance has been observed through F_1 and F_2 generations. However, the presence of ray florets could, of course, simply depict an ancestral feature of *P. lemmoni*, but this in itself is an interesting factor for future consideration of evolutionary relationships. None of the radiate species of sect. *Laphamia* appear at all closely related to *P. lemmoni*.

Unfortunately, although attempts have been made, no recent collections from Graham Mt. and Clifton have been secured.

13. PERITYLE DISSECTA (Torr. in Gray) Gray, Syn. Fl. N. Amer. 1:320. 1884.

Laphamia dissecta Torr. in Gray, Pl. Wright. 2:81. 1853. TYPE: TEXAS: Presidio Co, Presidio del Norte, August, 1852, *J. M. Bigelow s.n.* (Holotype, NY! Isotypes, GH! US!).
Leptopharynx dissecta (Torr. in Gray) Rydb., N. Amer. Fl. 34:24. 1914.

Plants 7-20 cm high, hirsute-pilose, densely leafy; leaves opposite or alternate, usually alternate above, 0.9-2.5 cm long, 0.4-1.5 cm wide, pilose to hirsute-pilose, irregularly dissected, once, twice, or thrice pinnately divided, less often pinnately parted or cleft, the lobes irregular and rounded; petioles (3) 4-10 mm long; capitulescence of solitary heads or small clusters on rather stout peduncles 0.2-0.8 (1.7) cm long; involucres campanulate; heads 8-10 mm long, 4-5 mm wide, typically partially obscured by leaves; receptacle convex (rarely somewhat flattened), 0.8-1.8 cm wide, 0.5 mm high; involucre obscurely 2-seriate, bracts 12-15, (5) 7-13 mm long, 0.5-0.9 mm wide, flattened, obscurely ribbed, linear-lanceolate, attenuate at the apex; ray flowers absent; disc flowers 20-30, corollas yellow, often purple tinged at maturity, (4.0) 5.0-5.5 mm long, the tube (1.0) 1.2-1.5 mm long, the throat typically distinctly narrowly tubular, less often barely subfunnelform, (2.0) 2.5-2.8 mm long, the lobes narrow, acute, 0.7-1.0 mm long; style branches 1.5-2.2 mm long; achenes (2.8) 3.0-3.8 mm long, oblong to narrowly obconical, rounded or obscurely angled usually on one surface, rarely both, with rather conspicuous callous margins, short-pubescent on the margins and both surfaces; pappus typically of 1 (rarely 0-4) rather stout bristle, (1.0) 2.2-3.0 mm long, and a vestigial but conspicuous crown of hyaline squamellae; in tetraploids especially, the squamellae appear to be reduced bristles; chromosome number, $n=17$, $n=34$.

Infrequent on limestone walls of canyons. Fig. 8. Spring-Fall.
Representative specimens:

TEXAS: Brewster Co. Santa Helena Canyon, Big Bend Nat'l Park, lower part of Mesa de Anguila Escarpment, *A. M. Powell 1244* (SRSC); lower walls, Santa Helena Canyon, *Sikes and Patterson 414* (SRSC); Santa Helena Canyon, Big Bend Nat'l Park, *B. H. Warnock 14196* (LL, SRSC, TEX). Presidio Co. mts. near Ross Mine, 5 mi W of Shafter, *L. C. Hinckley 3094* (LL, SRSC); canyon near old Ross Mine S side Chinati Mts., *Hinckley 3407* (GH); canyon of dry creek, Livingston Ranch, ca. 6 mi SW of Shafter,

Powell and B. Calvert 1255 (SRSC); Livingston Ranch, ca. 6 mi SW of Shafter, *Sikes and Patterson 413* (SRSC); on Santa Cruz Mt., near Presidio, *Warnock T632* (TEX, US); Ross Mine area, Chinati Mts., Livingston Ranch, *Warnock 18825* (SRSC); Ross Mine, Chinati Mts., *Warnock 19133* (SRSC). MEXICO: Chihuahua. 4 km NW of Picachos station, *W. P. Hewitt 178* (GH); Plomosas, *Hewitt 373* (GH); La Campana Experimental Ranch, near Encinillas, *I. Knobloch 623* (SMU).

In addition to its finely dissected leaves, *P. dissecta* is characterized by narrow, attenuate bracts, tubular disc corollas, sparse pilose to pilose-hirsute pubescence, stout main pappus bristle, rather prominent pappus squamellae, and limestone habitat.

On the basis of most evidence, especially morphological, *P. dissecta* appears related to *P. lemmoni* and *P. castillonii*. This contention is substantiated by chromatographic pattern data, although these characters indicate a closer relationship of *P. dissecta* and *P. castillonii*. The precise affinity of the three species is not clear. Available distributional information indicates that the taxa are well separated, but much of the area in between known populations has not been investigated thoroughly. One collection from Chihuahua, Mexico, *Knobloch 623* (Fig. 8), is somewhat intermediate morphologically and geographically between all three species, and thus the possibility exists that either the taxa actually intergrade or that separation is not complete. The Knobloch collection has epappose achenes like the northwestern populations of *P. castillonii*, leaf shape and pubescence more like *P. lemmoni*, and involucral bracts more like *P. dissecta*. Admittedly, the Knobloch specimen narrows the gap between the three species in question. However, in view of the numerous differences between known populations, it seems best at present to recognize three distinct specific entities.

Perityle dissecta, P. lemmoni, and *P. castillonii* seem to represent a distinct phylad within sect. *Laphamia*, but its exact origin remains obscure. Currently there are at least 3 plausible explanations for the origin of the group. 1) Perhaps most attractive is a possibility that the group was derived from a yellow-flowered member of sect. *Pappothrix*, such as *P. rupestris*. In one tetraploid population of *P. dissecta* (*Sikes and Patterson 414*), several vestigial bristles on somewhat angular achenes were observed. This possible reduction from a "Pappothrix pappus" is reminiscent of the situation in *P. vitreomontana* (sect. *Pappothrix*) and *P. bisetosa*. Also, in habit, *P. castillonii* is very similar to *P. rupestris*. 2) It is possible that the *P. dissecta* group represents taxa derived by "reduction" from species of sect. *Perityle*. The occurrence of rather conspicuous pappus squamellae (typical of sect. *Perityle* species) in some populations of *P. dissecta, P. castillonii*, and *P. lemmoni*, as well as other vegetative and floral similarities to known sect. *Perityle* species, lends some credence to this hypothesis. 3) A more remote possibility is that the group arose through hybridization of sect. *Pappothrix* and sect. *Perityle* species. The latter possibility is based largely on an impression that the vegetative and floral morphology, e.g., that of *P. castillonii*,

could have been derived from such likely parents as *P. rupestris* and *P. parryi* (sect. *Perityle*). The natural hybrid *P. parryi* X *P. rupestris* var. *albiflora* and synthetic hybrids of similar parentage (Powell, 1970; unpublished data) exhibit recombination features which warrant consideration of the hybridization hypothesis.

Three populations of *P. dissecta* have been sampled chromosomally, and in two of the colonies only tetraploid ($n=34$) plants were detected (Powell and Sikes, 1970). Tetraploids can not be distinguished from diploids morphologically except that some individuals have slightly larger vegetative and floral characteristics.

14. PERITYLE CASTILLONII I. M. Johnston, Journ. Arnold Arb. 22:122-124. 1941. TYPE: MEXICO: Coahuila. Canyon del Indio Felipe, Sierra Hechiceros, frequent in crevices of cliffs in deep canyon. 18 Sept 1940, *Johnston and Muller 1359* (Holotype, GH!).
Laphamia castillonii (Johnston) Everly, Contrib. Dudley Herb. 3:378. 1947.

Plants 5-22 cm high, rather sparse-pilose to hirsute-pilose, densely leafy; leaves opposite below, becoming alternate above, 1-2.8 (3.5) cm long, 0.8-2.2 cm wide, rather sparse-pilose to hirsute-pilose, deltoid-ovate to subcordate, irregularly serrate, lobed, or cleft, rarely parted, the major segments sometimes further lobed, the lobes acute to rounded; petioles 4-9.5 (13) mm long; capitulescence of solitary heads or small clusters on rather stout peduncles (1-15 mm long); involucres narrowly campanulate or broad funnelform, heads 6-8 mm long, 4-6 mm wide, typically partly obscured by leaves; receptacle convex, 0.9-1.5 mm wide, 0.5 mm high; involucral bracts 10-11 (13-14), 3.3-4.8 mm long, 0.5-1.3 mm wide, somewhat flattened to subkeeled, oblong-lanceolate, obtuse to acute at the apex; ray flowers absent; disc flowers 16-30, corollas yellow, purple tinged at maturity, 2.2-3.5 mm long, the tube 0.8-1.0 mm long, the throat narrowly or broadly tubular to subfunnelform, 1.0-1.8 mm long, 0.5 (1.2) mm wide, the lobes acute, 0.4-0.6 mm long; style branches (1.2) 1.8-2.0 mm long; achenes 1.8-3.0 mm long, oblong to very narrowly obconical, rounded or obscurely angled on one or both surfaces, with rather conspicuous callous margins, short-pubescent on the margins and both surfaces; pappus absent, of an incomplete crown of extremely obscure, vestigial squamellae, or of 1-2 (3) slender bristles, 1.5-2.5 mm long, one or two often much shorter than the others, or merely a nub; chromosome number, $n=17$.

Common in crevices of igneous rock exposures, typically canyon walls and bluffs, in E Chihuahua and adjacent Coahuila, Mexico. Fig. 8. Spring-Fall.

Representative specimens:

MEXICO: Chihuahua. crevices of lava cliffs near "Virulento." 16 mi S of Trincheras, *I. M. Johnston and C. H. Muller 1430* (GH); in crevices and bluffs of mts. in Bolson Gigantes, ca. 50 mi S of Ojinaga, *A. M. Powell, J. Scudday, and C. Surratt 1279* (SRSC); road to Barrillos, 9.2 mi SE of Ojinaga —Carmargo road, *Sikes and Patterson 411* (SRSC); road to Barrillos, 5.8 mi SE of Ojinaga—Carmargo road, *Sikes and Patterson 412* (SRSC). Coahuila.

Cañon del Indio Felipe, Sierra Hechiceros, *R. M. Stewart 10* (GH); Cañon del Indio Felipe, *Stewart 525* (GH).

Perityle castillonii differs most conspicuously from *P. lemmoni* and *P. dissecta* by its deltoid-ovate to subcordate leaves which are irregularly serrate-lobed or cleft, but not deeply dissected. The species is further distinguished from *P. dissecta* by shorter, broader, and more acute bracts, shorter disc corollas, rather slender and delicate bristles (if present), and igneous rock habitat.

Although *P. castillonii* is known only from 2 localities, the taxon shows the kind of variability which typifies most other species of sect. *Laphamia*. Specimens from the type locality exhibit 1-2 (3) delicate pappus bristles and much larger leaves than the "Virulento" plants which have epappose achenes and smaller leaves. Johnston (1941) explained this variability as "evidently ecological," as it undoubtedly is to some degree in most species of *Perityle*. In addition, however, in many isloated populations where variability involves two or more characters, there must be some fixation of genetic differences.

15. PERITYLE LINDHEIMERI (Gray) Shinners.

KEY TO THE VARIETIES

1a. Pappus bristle present; wide distribution . . 15a. var. *lindheimeri*.
1b. Pappus bristle absent, rarely present, but usually reduced; restricted distribution . . . . . 15b. var. *halimifolia*.

15a. PERITYLE LINDHEIMERI (Gray) Shinners var LINDHEIMERI Southwest. Nat. 4:204-209. 1959.

Laphamia lindheimeri Gray, Pl. Wright. 1:101. 1852. TYPE: TEXAS: Comal Co. perpendicular rocks on the banks of the Guadalupe River, Comanche Spring, near New Braunfels, May, 1850, *Lindheimer 314* and *937* (Holotype, GH! Isotypes, GH! NY! UC! US! Photograph, DS!).

Laphamia rotundata Rydb., N. Amer. Fl. 34:25. 1914. TYPE: TEXAS: San Estaban, Sept. 3, 1852, *Bigelow s.n.*, referred to *L. rupestris* by Gray, (Holotype, NY! Photograph, DS!).

Perityle rotundata (Rydb.) Shinners, Southwest. Nat. 4:204-209. 1959.

Plants (10) 18-45 (60) cm high, stems sparsely pubescent, densely leafy; leaves opposite below, alternate above, broadly ovate to ovate-lanceolate, 2-5 cm long, 1.0-3.5 cm wide, glandular-punctate, essentially glabrous, serrate-lobed especially on anterior margins, apex and base acute (sometimes subattenuate); petioles 0.4-1.0 cm long; capitulescence of numerous heads loosely to densely aggregated at tips of slender, often dichotomously branched peduncles; involucres narrowly campanulate, heads 6-7 mm long, 4-5 mm wide; receptacle flattened, ca. 2.0 mm wide; involucral bracts ca. 12, 3-4 mm long, ca. 2.0 mm wide, keeled; number of florets 16-22; ray flowers 3-5, pistillate and fertile, the tube 1.0-1.5 mm long, ligules yellow, 2.5-3.0 mm long, 1.5-2.0 mm wide, oblong to suborbicular, obscurely 3-lobed at apex; disc corollas yellow, 3.0-3.5 mm long, the tube 0.8-1.2 mm long, the throat narrowly campanulate, 1.0-1.5 mm long, the lobes acute, 0.5 mm long; style

branches ca. 1.5 mm long; achenes 2.0-2.8 mm long, linear-oblong to narrowly obconical, often rounded or obscurely angled on one or both surfaces, with thin callous margins, minutely pubescent on margins and surfaces; pappus of a single slender bristle (rarely 2 or none), 0.5-1.8 mm long, and a vestigial, laciniate crown of squamellae; chromosome number, $n=17$.

Common in crevices of cretaceous limestone rock exposures, particularly beside streams and springs, Edwards Plateau, Texas. Fig. 8. Spring-Fall. Representative specimens:

NEW MEXICO: Lincoln Co. at Alto, 7000 ft, *G. L. Fisher 36184* (US).

TEXAS: Bandera Co. head of Sabinal Canyon, 9 mi N of Vanderpool, *R. C. Barneby 13542* (CAS); along Sabinal River, 6 mi N of Vanderpool, *D. S. Correll and D. C. Wasshausen 28046* (LL); Vanderpool, *H. B. Parks 1045* (SMU); Vanderpool Canyon, *Parks 3112* (SMU). Bexar Co. Classen Ranch N of San Antonio, *R. D. Burr 287* (NY, TEX); San Antonio, *H. D. Slater s.n.* (US). Comal Co. 30 mi N of San Antonio, *E. D. Schultz 145* (US). Edwards Co. 14¼ mi SE of Rocksprings, *V. L. Cory 13973* (TEX); 14½ mi SE of Rocksprings, *Cory 20901* (GH); Polecat Creek, *Cory 38947* (TEX); Rocksprings, *G. O. Fisher s.n.* (CAS); Frio Water Hole, *R. T. Hill 42* (US); Northern Edwards Co., *E. J. Palmer 10960* (A. CAS, DS, US); NE exposures near Hwy 55, 13 mi S of Rock Springs, *A. M. Powell and S. Sikes 1325* (SRSC); Hackberry, *H. R. Reed 982* (TEX, US). Kendall Co. 5 mi S of Kendalia, *M. C. Johnston, T. Melchert and Powell 6494* (LL, TEX); Spring Creek, near Boerne, *Palmer 9827* (A, CAS, DS); Sabina Creek, near Boerne, *Palmer 13650* (A); Edge Falls near Kendalia, *Powell and B. Calvert 1235* (SRSC); Edge Falls, *B. C. Tharp s.n.* (TEX). Kerr Co. S fork of Guadalupe River, *Barneby 13543* (CAS); Turtle Creek, *W. L. Bray 185* (TEX, US); Lacey's Ranch, *Bray 229* (TEX, US); cliff above Turtle Creek, *Correll and Correll 12793* (LL, SMU); near Kerrville, *J. A. Drushel and S. G. Drushel 9883* (GH, NY); 13 mi SW of Kerrville, *C. C. Johnson s.n.* (DS); 5 mi W of Hunt, N fork of Guadalupe River, *R. W. Kelting 49* (TEX); Lacey's Ranch, *Palmer 9986* (A, DS); above Guadalupe River, 5½ mi SW of Hunt, *G. L. Webster 4310* (SMU, SRSC, TEX); N of Hunt, *E. Whitehouse s.n.* (TEX); 12 mi W. of Hunt, on N Guadalupe River, *Whitehouse 16325* (SMU, UC, US). Kimble Co. S fork of Llano River, 20 mi SW of Junction, *R. McVaugh 8282* (DS, GH, LL, SMU, SRSC, TEX); 15 mi SW of Junction, *J. M. Wilson 8815* (GH). Real Co. Echo Valley, *J. Baird 57* (TEX); area of Mengas and Grapevine Canyons, Prade Ranch, *Correll and E. C. Ogden 25334* (LL); area of Mengas and Grapevine Canyons, Prade Ranch, *Correll and Ogden 25335* (LL); 16 mi N of Leakey, *Cory 8574* (LL); Prade Springs, west Frio River, *Cory 12661* (TEX); Nueces Canyon, 7 mi S of Hwy 41, *Cory 51873* (DS, SMU); Barksdale, *Palmer 13523* (A); 13 mi W of Leakey, *Powell 1326* (SRSC); Horse Collar Bluff, 12 mi N of Leakey, *B. L. Turner 3629* (TEX, SMU). Travis Co. Austin, *E. D. Schultz 388* (GH, US); N of Austin, *Tharp 4714* (GH, TEX, US); Austin, *Tharp s.n.* (POM); W side of 3rd inlet to Lake Travis above Cow Creek, *Tharp s.n.* (TEX, SMU); Hamilton Pool, W of Austin, *White-*

house s.n. (NY, TEX, UC). Uvalde Co. Montell, *Palmer 12986* (A, GH); Nueces River, *Palmer 33694* (A, LL, NY); *Reverchon 82* (GH); 1 mi N of Concan, *H. D. Ripley and R. C. Barneby 11092* (CAS, NY); Garner State Park, *Turner 3852* (TEX).

Perityle lindheimeri is a widely distributed species of little variability, probably because of its rather uniform habitat and continuous distribution. The species is clearly related to *P. angustifolia*, and is easily distinguished from the latter by its ovate leaves, numerous, small, radiate heads, and pappus of a single bristle. According to label information, the type specimens with different collection numbers (*314* and *937*) are all from Lindheimer's original collection of the taxon. Specimens labeled *Lindheimer 314* are deposited at GH and NY, while specimens labeled *Lindheimer 937* are deposited at GH, NY, UC, and US.

15b. PERITYLE LINDHEIMERI var. HALIMIFOLIA (Gray) Powell, Sida 3:278. 1968.

Laphamia halimifolia A. Gray, Pl. Wright. 1:100. 1852. TYPE: TEXAS: Val Verde Co. crevices of rocks, on the summit of hills, near the San Pedro River, July, 1849, *Charles Wright 301* (Holotype, GH! Isotypes, DS! GH! NY! US! Photograph, DS!).

Perityle halimifolia (Gray) Shinners, Southwest. Nat. 4:204. 1959.

Very similar to *P. lindheimeri* var. *lindheimeri* in vegetative and floral features; pappus absent, or of an obscure callous crown, or in some individuals of a single bristle, 0.5-1.0 (1.5) mm long.

Restricted and isolated in distribution, rare on cretaceous limestone exposures in SW Val Verde Co., Texas. Fig. 8. Apparently flowers only in April-May and early June.

Specimens examined:

TEXAS: Val Verde Co. 8 2/3 mi S of Loma Alta, *Cory 41691* (GH, TEX); 12¾ mi S of Loma Alta, *Cory 44461* (TEX); 8 mi S of Loma Alta, *Powell and Calvert 1234* (SRSC); 8 mi S of Loma Alta, *Powell and Sikes 1322* (SRSC); Fawcett Lodge 20-30 mi up Devils' River, *B. H. Warnock 11175* (SRSC); between Del Rio and Loma Alta, *Warnock 11214* (LL, SRSC).

After further study it may prove necessary to submerge this variety with *P. lindheimeri*. Even though the delimiting pappus character breaks down, varietal rank was designated because the population is localized at the drier western periphery of the var. *lindheimeri* range, and the plants generally are smaller and somewhat depauperate in habit. Currently, the essentially epappose var. *halimifolia* serves to link *P. lindheimeri* with the related species *P. angustifolia*.

16. PERITYLE ANGUSTIFOLIA (Gray) Shinners, Southwest. Nat. 4:204. 1959.

Laphamia angustifolia Gray, Pl. Wright. 1:100-101. 1852. TYPE: between Texas and El Paso, 1851, *Charles Wright 1194* (Holotype, GH! Isotypes, GH! NY! US! Photograph, DS!).

Laphamia angustifolia var. *laciniata* Torr., Bot. Mex. Bound. 82. 1859.

TYPE: TEXAS: crevices of rocks along the Rio Grande, October, *Bigelow s.n.* (Holotype, NY! Isotypes, GH? US! Photograph, DS!).

Laphamia laciniata (Torr.) Rydb., N. Amer. Fl. 34:25. 1914.

Plants 8-25 cm high, stems minutely pubescent, densely leafy; leaves opposite below, alternate above, 1.5-3.0 cm long (0.2) 0.3-1.0 (1.5) cm wide, coriaceous, glandular-punctate, essentially glabrous, linear, oblanceolate, lanceolate, rarely ovate, typically 3—5-lobed or cleft, the lobes acute to attenuate, sometimes subentire or laciniate, obtuse, acute, or attenuate at the apex, attenuate at the base; subsessile to petiolate, petioles when present 0.4-1.0 cm long; capitulescence typically of several heads loosely aggregated at tips of dichotomously branched peduncles; involucres campanulate to narrowly so, heads 5.5-7.0 (9.0) mm long, 3.5-5.0 (6.0) mm wide; receptacle flattened; involucral bracts 12-14, 4.0-4.5 mm long, 1-2 mm wide, keeled; ray flowers absent; disc flowers 20-33 (50), corollas yellow, 2.2-2.8 (4.5) mm long, the tube 1.0-1.2 (1.5) mm long, the throat narrowly campanulate, 1.0 (1.5) mm long, the lobes acute, 0.5 (1.0) mm long; style branches ca. 1.0 mm long; achenes 2.0-2.5 (2.8) mm long, narrowly obconical to linear-oblong, often rounded or obscurely angled on one or both surfaces, with thin callous margins, minutely pubescent on margins and surfaces; pappus typically absent, except for a minute, vestigiate crown of squamellae, rarely with 1-2 bristles, 1.5-2.0 mm long; chromosome number, $n=17$.

Common in crevices of limestone, exposures (probably only Cretaceous), W Texas along and near the Rio Grande, and along the eroded W edge of the Edwards Plateau. Fig. 8. Spring-Fall.

Representative specimens:

TEXAS: Crocket Co. 32 mi NW of Ozona, *V. L. Cory 44389* (TEX); below roadside park at top of Lancaster Hill along US 290, *A. M. Powell and B. Calvert 1236* (SRSC). Pecos Co. SW of Sheffield, on and below rimrock of mesa, *D. S. Correll and D. C. Wasshausen 27967* (LL); on a bluff above the Ft. Stockton-Sanderson road, 34-40 mi S of Ft. Stockton, *L. C. Hinckley and Leon Hinckley 43* (SMU, SRSC); limestone cliffs on Owen's Ranch near Sheffield, *J. Scudday 51* (SRSC); mesa 30 mi S of Ft. Stockton, *B. C. Tharp s.n.* (TEX); on bluffs 15 mi SE of Ft. Stockton, *B. H. Warnock 20400* (SRSC); on bluffs 1 mi S of Sheffield, *Warnock 20401* (SRSC); 1 mi S of Sheffield, *Warnock 20402* (SRSC); bluffs 4 mi E of Brewster-Pecos Co. line, *Warnock 20406* (SRSC). Terrell Co. limestone hill 8 mi W of Sanderson, *Correll and M. C. Johnston 24588* (LL); limestone bluff 3 mi E of Sanderson, *Johnston, Powell and T. Melchert 6478* (LL, TEX); Sanderson, *C. R. Orcutt 728* (US); Mile Long Canyon at Langtry, *J. Skiles 7* (SRSC); hills 1 mi E of Sanderson, *Warnock 11887* (LL, SMU); 29 mi N of Dryden, *Warnock and Johnston 17252* (SRSC); Blackstone Ranch in little Horse Head Canyon, 16 mi S of Sheffield, *G. L. Webster 335* (TEX); Sanderson, *E. D. Wooten s.n.* (US). Val Verde Co. *Goldschmidt s.n.* (TEX); mouth of Pecos River, *V. Havard 33* (GH); roadside park, E side, Pecos River Canyon, *Johnston, Powell, and Melchert 6486* (LL, TEX); limestone bluffs, Pecos River Bridge, *Melchert and Powell 260*

(TEX); *G. C. Nealley 261* (DS, US); N of Hwy Bridge, W bluffs of Pecos River, *D. Patterson 48* (SRSC); Pecos River Bridge below roadside park, *Powell 1233* (SRSC); Pecos Canyon 12 mi W of Comstock, *F. Shreve 3872* (GH); 45 mi N of Del Rio, *Tharp s.n.* (TEX); limestone crevices, mouth of Pecos River, *Turner s.n.* (SRSC); along Devil's River at Highway Bridge, *Warnock 11755* (LL, SMU, SRSC).

Leaf shape and size is notably variable in this taxon. Plants exposed to the sun for most of the day typically exhibit narrower shorter, coriaceous leaves, while those of shade forms are usually much larger and thinner in texture. Plants growing in the shade also may grow larger than sun-exposed individuals, sometimes even trailing, and may form larger heads and florets. The taxon *P. laciniata*, recognized by Torrey and Rydberg, obviously is just a shade form, although one such larger plant growing in the shade recently has been found to be polyploid (n = ca. 51).

Perityle angustifolia differs from the closely related *P. lindheimeri* by its reduced habit, leaf shape, larger and fewer heads per cluster, discoid heads, and epappose achenes. A single plant of one collection (*Patterson 48*) was observed to have 1-2 pappus bristles. The exomorphic features of *P. angustifolia*, and the more xerophytic habitat, strongly suggest that the taxon evolved from *P. lindheimeri* by adaptation to drier conditions as it became geographically isolated by erosion of the Edwards Plateau caprock.

17. PERITYLE STAUROPHYLLA (Barneby) Shinners, Southwest. Nat. 4:205. 1959.

Laphamia staurophylla Barneby, Leafl. West. Bot. 8:168. 1957. TYPE: NEW MEXICO: Otero Co. limestone bluffs in La Luz Canyon below High Rolls, western slope of Sacramento Mts., 2 Sept 1956, *R. C. Barneby 12889* (Holotype, CAS! Isotypes, GH! K, NY! RSA! UNM! US!).

Plants 15-40 cm high, as rather small, singular plants or in dense clumps to 60 cm in diameter, scabridulous to nearly glabrous, densely leafy; leaves opposite or alternate but usually alternate, 1.7-3.8 (4.0) cm long, 1.0-2.5 cm wide, scabridulous to nearly glabrous, subcoriaceous, deeply divided into 3 conspicuous narrow, flattened (rarely subterete) lobes, the lobes, especially the 2 lateral ones, often secondarily lobed, cleft or parted, lateral lobes at antrorse angles or perpendicular to central lobe, whole leaf subcruciform to cruciform (rarely bi-tripinnate) in appearance; capitulescence of several loosely (rarely densely) aggregated heads; involucres campanulate, heads 6.0-7.5 mm long, 4.5-6.0 mm wide, often partly obscured by upper leaves; receptacle convex, 1.5-2.0 mm wide, 0.5-0.8 mm high; involucre of 2 equal series (appearing uniseriate), bracts 13-16 (22), 3.5-4.0 mm long, 0.7-1.1 (1.8) mm wide, sublanceolate, keeled; ray flowers 4-8 (rarely absent), pistillate and fertile, the tube ca. 2.4 mm long, ligules yellow, 3.6-4.8 mm long, oblong, 3-toothed at the apex, an inner lobelet of ligule sometimes present, often 2-3 vestigial anthers apparent; disc flowers 40-50, corollas yellow, 3.8-4.5 mm long, the tube 1.5-1.6 mm long, the throat subtubular to narrowly funnelform,

1.5-2.0 mm long, the lobes acute, 0.6-0.8 mm long; style branches 1.5-1.8 mm long; achenes 1.8-2.3 (2.7) mm long, oblong-obconical to obconical-elliptic, typically flattened, slightly rounded on both surfaces, rarely with a third angle on one surface nearer to one primary margin, with thin callous margins, short-pubescent on the margins especially and both surfaces; pappus typically of 2-3 bristles, less often 4-6, and an obscure crown of minute hyaline squamellae which may appear as vestigial bristles or nubs, the squamellae sometimes seemingly absent, the bristles 1.8-2.5 mm long, third and fourth, if present, usually shorter than the main 2; chromosome number, $n = 17$.

Locally common in limestone and granitic exposures in the SW Sacramento Mts. near the type locality, and in the San Andres Mts. Fig. 8. Spring-Fall.

Specimens examined:

NEW MEXICO: Doña Ana Co. San Andres Mts., E slope of Goat Mt., just N of San Andres Pass, *R. Spellenberg and T. Todsen 2641* (SRSC). Otero Co. Dog Canyon, Sacramento Mts., *E. F. Castetter 8124* (UNM); 1.5 mi W of High Rolls, along Hwy 82 toward Cloudcroft, Sacramento Mts., *Powell 1276* (SRSC); 9 mi W of Cloudcroft, *S. Sikes 67* (SRSC); mouth of Dog Canyon, 9 mi S of Alamogordo, *Spellenberg and Todsen 2555* (SRSC). Sierra Co. San Andres Mts., Rhodes Canyon, 9 mi W of Rhodes Canyon Range Center, *Spellenberg and Todsen 2537* (SRSC); San Andres Mts., near mouth of Cottonwood Cave, *Spellenberg and Todsen 2547* (SRSC); San Andres Mts., 11 mi W of Rhodes Canyon Range Center, *Spellenberg and Todsen 2637* (SRSC).

Perityle staurophylla is an endemic species which is characterized by its variable pappus of 2-6 bristles, rather small heads with 4-8 ray florets, subcorymbiform inflorescence, and variable leaves. The phylogenetic position of this species within sect. *Laphamia* is not at all clear, but several features of the taxon suggest possible relationships which are of theoretical interest with regard to the biosystematics of *Perityle*. The single most enigmatic feature of *P. staurophylla* revolves around the structure of its pappus. It should be remembered that the pappus is quite variable among the species of *Perityle*, and one must be careful in evaluating the taxonomic significance of this character. However, an understanding of the origin of the pappus in *P. staurophylla* would appear to be tantamount to understanding its phylogeny.

The variable pappus bristle structure (length and number) of *P. staurophylla* could be construed as a reduced *Pappothrix* condition (20-30 bristles) somewhat like that found in *P. vitreomontana*, sect. *Pappothrix* (Powell, 1969). In addition, some achenes of *P. staurophylla* are 3-4 angled, and thus nearly intermediate between the more typical flattened achenes of *P. staurophylla* and the obscurely 4-angled fruits characteristic of *Pappothrix* species. However, as noted by Barneby (1957), the general appearance of *P. staurophylla* does not indicate close affinity with any of the species of sect. *Pappothrix*. The lack of close relationship with sect. *Pappothrix* is

further amplified by details of vegetative and floral morphology.

In leaf morphology, *P. staurophylla* resembles *P. gilensis* and *P. saxicola* (Arizona), and to a lesser extent, *P. coahuilensis* (Mexico). Leaves of the four taxa are not alike, but they are variably tripartite and subcruciform. Other characteristic features of these species do not suggest any close relationship, however, and it is possible that the similar leaf shapes have been evolved independently. The tendency for trilobed leaves is apparent in many species of *Perityle* which appear unrelated to *P. staurophylla.*

Since the pappus structure of this species is somewhat intermediate between sect. *Pappothrix* and sect. *Laphamia*, several plausible explanations regarding its origin are amenable to consideration. *Perityle staurophylla* could have arisen from some ancestral species of sect. *Pappothrix* in much the same fashion as *P. bisetosa* is suspected to have been derived from sect. *Pappothrix* (Powell, 1969; present paper). No direct evidence is available to support the latter hypothesis. On the other hand, most morphological evidence, other than the pappus, suggests a closer relationship of *P. staurophylla* to species of sect. *Laphamia* than to species of sect. *Pappothrix.* Also, a relationship of *P. staurophylla* to sect. *Laphamia* is supported by chromatographic comparisons, where its pattern most closely resembles that of some southwestern species, especially *P. gracilis.* Certainly *P. staurophylla* does not appear to have any immediate affinity with *P. gracilis*, but its presumed relationship with sect. *Laphamia* would seem to be strengthened by the crude chemical data.

It is possible that *P. staurophylla* resulted from interspecific hybridization with a species of *Pappothrix* as one parent. This could account for the leaf and pappus variability in *P. staurophylla*, and for the restricted distribution of the taxon. The likelihood of intersectional hybridization has been enhanced through greenhouse experimentation where numerous artificial F_1 combinations between all three sections of *Perityle* have been obtained (Powell, unpublished). A likely multibristled parental suspect would be *P. quinqueflora* (sect. *Pappothrix*) which is known to occur in the Guadalupe Mts. of New Mexico, not far south of the *P. staurophylla* habitat. Theoretically, besides the pappus, *P. quinqueflora* could have contributed the following features to *P. staurophylla*: Yellow flowers, small heads, subcorymbiform inflorescence, subcoriaceous leaves, and glabrosity. If *P. staurophylla* did indeed have hybrid origin, another likely parent with close geographic distribution is not easy to find. The most attractive candidates appear to be *P. lindheimeri, P. angustifolia*, and *P. coronopifolia* (sect. *Perityle*). *Perityle* cf. *lindheimeri* has been collected at Alto, New Mexico (*Fisher 36184*) although I have not been able to find it at that locality. Spontaneous greenhouse hybrids between *P. lindheimeri* X *P. coronopifolia* have been reported by Ripley (1957), but these do not resemble *P. staurophylla.* For various reasons none of the possible parental combinations mentioned above meet all the logical requirements for *P. staurophylla* ancestry. At any rate, further conjucture along this line of thought is not warranted.

18. PERITYLE **coahuilensis** Powell, sp. nov. Fig. 9. TYPE: MEXICO: Coahuila. deep narrow canyon, ca. 2 km SE of Puertecito, W end of Sierra de la Madera, ca. lat. 27 15 N 21 Sept 1941, *I. M. Johnston 9311* (Holotype, GH! Isotype, GH!).

Plantae 15—35 cm altae, glabrae; caules albidi, glanduloso-tuberculati; folia vulgo alterna, raro opposita, 1.4—2.6 cm longa, 0.7—1.4 cm lata, glabra, glanduloso-punctata, subcoriacea, vulgo cruciformia ad palmatim triloba vel trifida segmentis vulgo lobulatis vel serratis (aliunde folia deltoidea vel ovata marginibus irregulariter serrato-lobulatis); petioli 0.6—1.7 cm longi; involucra anguste campanulata vel subcylindrica, capitula 0.8—1.0 cm longa, 4—6 mm. lata; flores radii vulgo desunt, disci 24—30 corollis flavis (Demum purpurascentibus), 4.0—5.5 mm longis faucibus tubulosis 2.0—2.5 mm longis; achaenia 3.4—3.6 mm longa, anguste obconica ad linearia marginibus (valde callosis) faciebusque brevipubescentibus; pappus seta unica valida (raro duabus); chromosomata $n=27$-34.

Known only from SW Coahuila, Mexico, growing in crevices of limestone bluffs in protected canyons. Fig. 8. Spring-Fall.

Representative specimens:

MEXICO: Coahuila. Cañon del Agua Grande, ca. 2 km W of Ejudo Las Delicias, *S. Sikes and D. Patterson 399* (SRSC); Cañon del Agua Grande, Sierra del Sobaco, a few km W of Las Delicias, *R. M. Stewart 2803* (GH).

This rare and unusual species has commanded special attention with regard to systematic studies in sect. *Laphamia*. In the first place, it has not been possible to realize any certain interspecific relationship for *P. coahuilensis*. The taxon is best delimited by its essentially glabrous, subcoriaceous, typically subcruciform leaves, discoid heads, and pappus of a single bristle. Its chromosome number ($n=27$-34) presumably is tetraploid on the base of $x=17$, although attempts to obtain an accurate count have not been successful. Considering leaf shape and texture, *P. coahuilensis* resembles *P. staurophylla* ($n=17$), but several floral differences appear to negate any close relationship with the latter taxon. Superficially, in vegetative and floral habit (including disc corollas), *P. coahuilensis* compares with *P. vaseyi* ($n=17$) of sect. *Perityle*, but its achene morphology (including absence of pappus squamellae) definitely is Laphamoid in nature.

Ontogenetic comparisons of *P. coahuilensis* with putative relatives have revealed initially surprising but rather convincing evidence that the taxon has affinity with *P. angustifolia*. Characteristically, *P. angustifolia* has much smaller heads than does *P. coahuilensis*, but shade forms of the former species are found to produce heads which equal those of *P. coahuilensis* in size and general morphological conformation. During the development of heads on plants of both species, just before anthesis, disc floret buds protrude uniformly from the involucral bracts in a manner which apparently is not matched exactly by any other species of the section. Further observations also show that *P. coahuilensis* and *P. angustifolia* compare almost exactly in every aspect of habit except for very conspicuous differences in

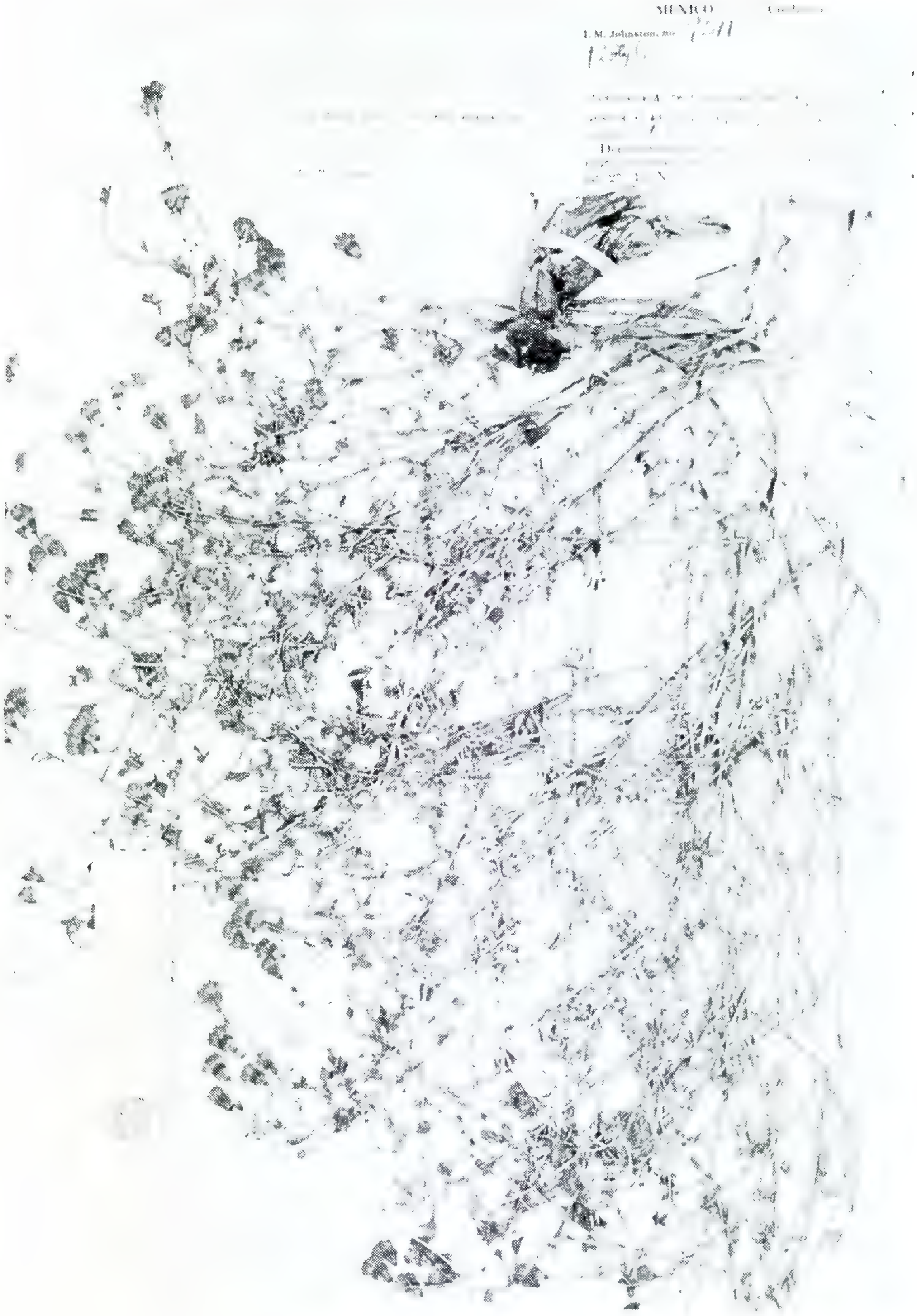

Fig. 9. *Perityle coahuilensis*: photograph of holotype (GH), *I. M. Johnston 9311*.

typical leaf shape (e.g., similarities in whitish basal stems, leaf glabrosity and texture, and leaf arrangement). Furthermore, it should be noted that leaves in a few plants of *P. coahuilensis* depart from the typical subcruciform shape and approach *P. angustifolia* in being irregularly serrate-lobed.

The above observations would appear to suggest the possibility that *P. coahuilensis* has arisen as a tetraploid offshoot from *P. angustifolia*. This possible lineage is not supported, however, by some important floral features of *P. coahuilensis*. The florets of *P. angustifolia* are epappose, have narrowly campanulate throats, and are much smaller than are those of *P. coahuilensis* which exhibit a single bristle and have long, tubular throats. Indeed, such floral differences could have resulted from polyploidy and modification through speciation, but essentially only quantitative variation is characteristic of numerous other polyploid species in *Perityle*.

Attention has been given to the possibility that *P. coahuilensis* is of intersectional hybrid origin since it exhibits some features which are characteristic of both sect. *Laphamia* and sect. *Perityle*. Among the species of sect. *Perityle*, *P. coahuilensis* bears closest resemblance to *P. vaseyi*, most notably in general habit, leaf shape, pappus bristle, and disc corolla characters. The distribution of *P. vaseyi* in Mexico is known to be proximal to that of *P. coahuilensis*. Several sect. *Laphamia* X sect. *Perityle* hybrids have been synthesized in the greenhouse (Powell, unpublished), thus supporting the possibility of natural intersectional hybridization.

Besides *P. angustifolia* and *P. vaseyi*, there is some evidence that *P. castillonii* might have contributed to the genome of *P. coahuilensis*. The latter species and *P. vaseyi* are the only taxa which are known to occur close to the distributional range of *P. coahuilensis*. Interestingly, *P. coahuilensis* exhibits disc corollas which turn purplish at maturity, a relatively rare trait in yellow-flowered species of the genus *Perityle*. Among the species relevant to this problem, purplish corollas are found in *P. castillonii*, *P. dissecta* (related to *P. castillonii*) and *P. aglossa* (related to *P. vaseyi*). A chromatographic study of *P. coahuilensis* and possible relatives has not contributed any solid evidence with regard to its origin. However, one prominent yellow compound (as yet unidentified) of the *P. coahuilensis* pattern apparently occurs elsewhere only in *P. castillonii* and its ally, *P. dissecta*.

Additional factors have given reason to suspect that *P. coahuilensis* is of hybrid origin. Unusual leaf variation (particularly in degree of lobing and dissection) has been detected in individual plants from a population near Las Delicias, Coahuila, Mexico. Population to population variation in leaf morphology actually is common among the species of *Perityle*, but plant to plant differences of the sort which have been found at Las Delicias are unexpected. Meiosis, observed only in greenhouse plants of *P. coahuilensis*, is irregular to such an extent that an accurate chromosome count could not be made. Although it is possible that the unnatural greenhouse environment (or autopolyploidy) could have some effect on meiosis, this cytological condition at least occasions a suspicion of hybrid involvement. Also, one green-

house plant of *P. coahuilensis* was observed to produce a single ligule (ray floret) in one head and 2 ligules in another head. The plant was grown from a woody caudex which was taken from the population near Las Delicias. The significance of this potential to produce a ray floret in a normally discoid plant cannot be interpreted at this time, but perhaps it is reasonable to anticipate that *P. coahuilensis* has a radiate ancestor in its pedigree.

Additional conjecture with regard to the origin of *P. coahuilensis* would seem to have little value. After all, the species grows in one of the most inaccessible regions of North America, and is known from only 3 collections. Perhaps further botanical exploration of southwestern Coahuila, Mexico, and continued experimental studies will result in a better understanding of the taxon.

19. PERITYLE **cochisensis** (Niles) Powell, comb. nov.

Laphamia cochisensis Niles, Mem. N.Y. Bot. Gard. 21:47-49. 1970. TYPE: ARIZONA: Cochise Co. North-facing cliffs of Echo Canyon, elev. ca. 2000 m, Chiricahua Nat'l Mon., 5 Oct 1964, *Niles 377* (Holotype, ARIZ).

Plants 4-12 cm high, stems almost glabrous to sparsely or densely short-pubescent; leaves alternate, 1.5-3.5 cm long, 0.8-2.7 cm wide, subglabrous to hispidulous, subdeltoid, ovate, to deltoid-orbiculate in outline, irregularly lobed or cleft or subcruciform with 3-5 segments, segments serrate or lobed; petioles 0.7-1.5 cm long; capitulescence essentially of solitary heads on very short peduncles (ca. 0.5 cm); involucres broadly campanulate, heads 0.8-1.0 cm long, ca. 1.0 cm wide; involucre of 2-3 equal series, bracts 5.0-6.5 mm long, 1.0-2.5 mm wide, lanceolate to lanceloate-ovate or ovate, acute-obtuse at the apex; ray flowers absent; disc flowers 30-45, corollas yellow, ca. 3.5 mm long, the throat funnelform to narrowly campanulate, ca. 2.0 mm long; achenes 2.5-3.0 mm long, linear to narrowly obconical, with thin callous margins, ciliate-pubescent on the margins, short-pubescent on the achene surfaces; pappus of one slender bristle, 2.0-2.5 mm long, or with the main bristle and a shorter one arising from the opposite margin, bristles subplumose distally, and pappus usually of an inconspicuous, partial, or complete crown of hyaline squamellae; chromosome number, $n = 17$.

Apparently restricted to granite rocks in canyons, Chiricahua National Monument. Fig. 3. Spring-Fall.

Representative specimens:

ARIZONA: Cochise Co. Bonita Canyon, Chiricahua Nat'l Mon., *O. M. Clark 8611* (UNM); crevices of granite rocks, near scenic hilltop, Chiricahua Nat'l Mon., *A. M. Powell and D. Patterson 1628* (SMU, SRSC, TEX); N slopes of Reed Mt., 1 mi E of Southwestern Research Sta., Chiricahua Mts., *T. K. Todsen 2007* (SRSC).

The taxonomic position of this endemic species is uncertain. There is some evidence that the taxon is related to *P. lemmoni* which also grows in sandstone rocks in southeastern Arizona. *Perityle cochisensis* and *P. lemmoni* are alike in certain aspects of floral structure, especially in achene shape,

corolla shape, and slender pappus bristles, but otherwise there is no clear morphological indication of relationship. For example, the lobed or cleft and almost glabrous leaves of *P. cochisensis* differ considerably from those of *P. lemmoni* which are laciniate-dissected and densely pilose. Also, the achene margins of *P. cochisensis* exhibit ciliation which approaches that of sect. *Perityle* species, and the pappus usually is comprised of 2 slender bristles, unlike *P. lemmoni* which has short-pubescent achene margins and usually one pappus bristle.

As with a few other species which have nebulous infrasectional relationships, it seems appropriate to consider the possibility that *P. cochisensis* originated from intersectional hybridization. Both *P. lemmoni* and *P. coronopifolia* (sect. *Perityle*) occur in the same general distributional area with *P. cochisensis*, although apparently not sympatrically, and the floral and vegetative morphology is somewhat like that which would be expected in hybrids between *P. lemmoni* and *P. coronopifolia*. Certainly the ciliated achene margins and 2 pappus bristles of *P. cochisensis*, as well as the variable leaf forms found among individual plants, are characters which could have been inherited from *P. coronopifolia*. It must be noted, however, that in several artificial intersectional crosses between radiate and discoid species (Powell, unpublished), F_1 hybrids always have developed ligules, and *P. cochisensis* is discoid.

20. PERITYLE GRANDIFOLIA Brandeg. Zoe 5:224:225. 1905. TYPE: MEXICO: Sinaloa. Cerro Colorado, vicinity of Culiacan, 5 Nov 1904, *T. S. Brandegee s.n.* (Holotype, UC! Isotype, GH! US! Photograph NY!).
Leptopharynx grandifolia Rydb., N. Amer. Fl. 34:23. 1914.
Laphamia grandifolia (Brandeg.) Everly, Contrib. Dudley Herb. 3:379. 1947.

Plants 12-25 (50) cm high, stems pilose; leaves opposite or alternate, 8-11 cm long, 4-6 cm wide, pilose, thin in texture, broadly ovate, apex acute, base truncate, margins serrate to doubly serrate or somewhat crenate; petioles 2.5-4.5 cm long; capitulescence subcymose, typically with 3-6 heads loosely aggregated on peduncles which are 3.5-4.5 cm long; involucres campanulate, heads 7-9 mm long, 7-8 mm wide; involucral bracts 5.0-6.5 mm long, 0.5-1.0 mm wide, linear, somewhat keeled, and with 2 conspicuous costae; ray flowers pistillate and fertile, the tube 2.0-2.3 mm long, ligules yellow, 5-6 mm long, 1-2 mm wide, oblong; disc corollas yellow, 3-4 mm long, the tube 1.0-1.5 mm long, the throat tubular, ca. 2.0 mm long, lobes 0.5 mm long, narrow and acute; style branches 1.5-2.0 mm long; achenes 2-3 mm long, linear-oblong and slightly curved, glabrous, callous margins absent, with a conspicuous, truncate, callous carpopodium, 0.1-0.2 mm long; pappus absent, but inconspicuous callous crown present; chromosome number, unknown.

Apparently very rare on limestone cliffs, at ca. 5000 ft. Fig. 3.

Specimen examined:

MEXICO: Sinaloa. Puerto a Tamiapa, *H. S. Gentry 5850* (ARIZ).

Perityle grandifolia is easily set apart from other species of sect. *Laphamia* by its large leaves which are broadly ovate, 8-11 cm long, and 4-6 cm wide. The taxon does not exhibit obvious relationships with any other member of the section. Instead, *P. grandifolia* shows closest vegetative resemblance to the larger leafed forms of *P. cordifolia* (sect. *Perityle*), although its achene morphology is definitely Laphamioid.

On the basis of most exomorphic characters (e.g., large, pilose leaves and radiate, yellow-flowered heads), *P. grandifolia* fills many expectations of an ancestral taxon in sect. *Laphamia*. The essentially epappose, emarginate, and glabrous achenes of *P. grandifolia* are considered to be derived features in the section, but an ancestral status can not be ruled out by these characters alone. In fact, in addition to the radiate heads and a few other features, this species can be linked with *P. stansburii* and the "southwestern alliance" through an interesting technical character of the achenes. The rather prominent callous carpopodium of *P. grandifolia* has been observed to occur elsewhere in the section only in *P. stansburii, P. megalocephala,* and *P. inyoensis*, although in the latter taxa the carpopodium is a less prominent but obvious nipple-like structure.

21. PERITYLE **gentryi** A. M. Powell, sp. nov. Fig. 10. TYPE: MEXICO: Sonora. Saguaribo, Rio Mayo, transition pine country, 5500 ft., 2 Nov 1935, *H. S. Gentry 2109* (Holotype, GH! Isotypes, ARIZ! UC! US!).

Plantae 5—25 cm altae, prostratae vel pendentes, piloso-villosae; folia opposita, pilosa, 1.5—2.5 cm longa, 0.8—1.8 cm lata, ovata ad ovato-deltoidea serrata vel duplo-serrata; involucra anguste campanulata, capitula 7—9 mm longa, 5—7 mm lata; flores radii 6—10, ligulis flavis, 4—5 mm longis, ca. 2.0 mm latis, oblongo-ovatis; disci flavae, 3—4 mm longae; achaenia 2—3 mm longa, oblonga ad angustissime obconoca, glabra nisi pilis brevibus ad margines faciesque adspersis, marginibus conspicue callosis; pappus nullus; chromosomata ignota.

The single Gentry collection of this species was discovered among exsiccata which has been lumped under *P. leptoglossa* and *P. palmeri* of sect. *Perityle*, probably because of vaguely similar radiate heads and a *Perityle*-like habit. Examination of the achenes, however, indicates that it is correctly placed with sect. *Laphamia*. It is worthy to note that *P. gentryi* further manifests the habit similarity of traditional *Perityle* and *Laphamia*, and serves to support congeneric recognition of the taxa (Powell, 1968a).

Perityle gentryi is not clearly allied to any of the Laphamian species. In some respects it resembles a miniature *P. grandifolia*. Both taxa have yellow-flowered radiate heads, similar leaves (although those of *P. gentryi* are much smaller), pilose pubescence, and epappose achenes. These species differ considerably in technical aspects of the achenes, however, and this characteristic in *Perityle* usually is a reliable indicator of taxonomic affinity. Based upon fruit morphology, *P. gentryi* would appear closer to the yellow-flowered discoid taxa, *P. villosa* or *P. lemmoni*.

Fig. 10. *Peritule gentryi*: photograph of holotype (GH), *H. S. Gentry 2109*.

EXCLUDED SPECIES

Laphamia peninsularis Greene, Bull. Calif. Acad. Sci. i.n. I. pp. 8-9. 1884. TYPE: MEXICO: Scammon's Lagoon, on the peninsula of Lower California, collector unknown. (Holotype, CAS? Fragment of Type US!). = *Amauria rotundifolia* Benth.

Laphamia scopulorum Jones, Contrib. West. Bot. 12:48. 1908. TYPE: MEXICO: CHIHUAHUA: Colonia Juarez, 6000 ft., Sept. 1903, *M. E. Jones s.n.* (Holotype, POM; fragment of Type, US!). = *Perityle coronopifolia* Gray.

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Manuscript received for publication ca October 1970 (Editor's note).

NOTES

ISOETES LOUISIANENSIS (ISOETACEAE), A NEW SPECIES FROM LOUISIANA.—In April 1972, one of us (GL) collected megasporangiate specimens of a quillwort, *Isoetes*, in Thigpen Creek near Enon, Washington Parish, Louisiana. In September we gathered microsporangiate specimens. These collections represent an undescribed species.

Thigpen Creek, like many streams in eastern Louisiana, is cool and clear, has a silty-sandy bottom, and flows through a pine-hardwood forest. Besides *Isoetes*, aquatics in the stream were *Orontium aquaticum, Potamogeton pusillus*, and *Sparganium americanum. Isoetes* was found under a highway bridge and also about ¼ mile upstream. While some plants were stranded, others were in the middle of the stream and would be stranded only if the stream dried up—an unlikely event. *Isoetes* plants, with surrounding soil, were moved in pots to the USL greenhouse where, submersed in an aquarium, they have thrived for 3 months.

Enon is only 18 miles from the Louisiana-Mississippi border, suggesting that the new species may occur in the latter state, where *Isoetes* is not yet known. Further exploration will probably result in finding additional Louisiana sites for the species. The only *Isoetes* previously collected in Louisiana is *I. melanopoda* Gay et Dur., considered rare in the state.

The megaspores of *I. louisianensis* are like those of *I. engelmannii* var. *caroliniana* in that they possess "high reticulate ridges, much crisped and cut with an irregular margin, producing [a] somewhat spiny effect" (N. E. Pfeiffer, Ann. Missouri Bot. Gard. 9:207. 1922). The microspores and the velum are also similar to those of this variety. Sharply separating the new species from *I. engelmannii* var. *caroliniana* is its brown-spotted sporangial wall.

The number of peripheral strands is variable. A few leaves had no strands at all; others, one to three, weakly to strongly developed; and some, as many as 28, evenly distributed.

ISOETES **louisianensis** Thieret, sp. nov. Statura, velum, et sporae *I. engelmannii* var. *caroliniana* similis, praecipue differt sporangiis maculatis.

Cormi 2-lobati. Folia numerosa, plerumque 15-40 cm longa, plus minusve plana adaxialiter, rotundata abaxialiter; stomata praesentia; ligulae triangulares usque ovatae, 2.0-3.0 mm longae; fila peripheralia 0-28. Sporangia oblongo-elliptica, maculis brunneis conspersa, 6.5-8.0 mm longa, 3.0-4.0 mm lata, velo 1/3-½ obsita. Megasporae albae, irregulariter cristato-reticulatae, 500-625 mm diametro; microsporae brunneolae, dense spinulosae, 25-35 mm longae.

HOLOTYPE (GH): Louisiana: Washington Parish. In and along Thigpen Creek 1 mile E of Enon, 21 Apr 1972, *Garrie Landry 200*. Isotype at MICH.

PARATYPE (GH, MICH): Louisiana: Washington Parish. In and along Thigpen Creek 1 mile E of Enon, 30 Sep 1972, *John W. Thieret 33660*.

We acknowledge the advice of Dr. Warren Wagner in the preparation of this paper.—*Garrie Landry and John W. Thieret, Department of Biology, University of Southwestern Louisiana, Lafayette, Louisiana 70501.*

DYSSODIA TENUILOBA (COMPOSITAE): NEW TO MISSISSIPPI.—In his monograph of the genus *Dyssodia* (University of California Publications in Botany, Volume 48. 1969), Dr. John Strother states that *Dyssodia tenuiloba* (DC.) Rob. var. *tenuiloba*, native to southern Texas and northeastern Mexico, has become established in Florida, Cuba, the Bahamas, Africa, and Asia. I have recently collected the taxon near the beach on the Gulf of Mexico in southern Mississippi: Harrison Co.: U. S. 90, between Gulfport and Biloxi; occasional; rays and disk yellow-orange. *David Flyr 1358*, 22 April 1970 (Specimens deposited at GH, SMU, UC).

It seems likely that the species may have been introduced as recently as 1969, when the center of the extremely destructive hurricane Camille passed over this portion of the Gulf Coast, having come across the Gulf from Cuba. There was no other typical beach or dune vegetation to be seen on this stretch of the coastal highway.

The chromosome number of the plant has been determined by Dr. Strother to be $2n=24$. The plant is thus a triploid on a base of $x=8$. This chromosome number was not among those published in Strother's monograph for this taxon.—*David Flyr, Route 1, Stratford, Texas 79084.* (See SIDA 5(1): 58—Editor)

ADDITIONS TO THE LOUISIANA FLORA.—The following species may be added to the flora of Louisiana.

Eleocharis elongata Chapm. St. Tammany Parish: mostly submersed, flowering culms emersed, in Bayou Lacombe, 6 miles N of Lacombe, *John W. Thieret 32416* (LAF), 10 Oct 1970; same locality, *Allen 2901* (LAF), 23 Sep 1972. The previous recorded United States range of this species was Georgia and Florida (Svenson, 1957).

Corallorhiza odontorhiza (Willd.) Nutt. St. Helena Parish: rich woods, 5 miles NNW of Chipola, *Allen 1691* (LAF, LSU), 8 Oct 1971. This orchid was to be expected in Louisiana as it is found in neighboring Mississippi and Arkansas (Correll, 1950; also *in litt.*). Louisiana's orchid flora is now 37 species, of which 19 occur in St. Helena Parish.

Geranium texanum (Trel.) Heller. St. Landry Parish: weedy area, 3.5 miles NW of Whiteville along road to Bunkie, *Thieret 32999*, 30 Apr 1971 (LAF). Rapides Parish: weedy area, Chambers, 8 miles S of Alexandria, *Thieret 33064*, 1 May 1971 (LAF). This species previously was considered endemic to Texas (Correll and Johnston, 1970).

Euphorbia hypericifolia L. Lafayette Parish: weed on USL campus, Lafayette, *Allen 2934* (LAF), 5 Oct 1972. The nomenclature used here is that of Correll and Johnston (1970). Wheeler (1941) applied the name *E. glomeri-*

fera (Millsp.) L. C. Wheeler to this species, which he ascribed to Florida and Texas in the United States.—*Charles M. Allen, University of Southwestern Louisiana, Lafayette, Louisiana 70501.*

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CORRELL, D. S. 1950. Native orchids of North America north of Mexico. Chronica Botanica Co., Waltham, Mass.

CORRELL, D. S. and M. C. JOHNSTON. 1970. Manual of the vascular plants of Texas. Texas Research Foundation, Renner, Texas.

SVENSON, H. K. 1957. *Eleocharis*. pp. 509-540 *in* N. Amer. Fl. 18(9).

WHEELER, L. C. 1941. *Euphorbia* subgenus *Chamaesyce* in Canada and the United States exclusive of south Florida. Rhodora 43:97-154, 168-205, 223-286.

FILIFORM CREEPING RHIZOMES IN SOLIDAGO JUNCEA (COMPOSITAE).—Fernald (Rhodora 38:212. 1936) suggested an easy way to separate *Solidago juncea* Ait. from *S. missouriensis* Nutt.: the absence of filiform creeping rhizomes ("filiform stolons") in *S. juncea* and their presence in *S. missouriensis*. One exception he noted was that *S. juncea* from the sandy southeastern section of Massachusetts did develop rhizomes similar to those of *S. missouriensis*.

I have found other areas where *S. juncea* develops rhizomes and thus would like to warn against using this character to separate the taxa. *Solidago juncea* at its southeasternmost limit—in Tennessee, Alabama, and Georgia—consistently has rhizomes, probably helping it become and remain established there. On Sand Mt. (northeastern Alabama) in 1970, in a large population of *S. juncea*, less than 2% of the plants flowered. The rest persisted as rosettes and freely produced rhizomes. In southern Illinois in 1972, another population of rhizome-producing *S. juncea* was observed; most of the plants were flowering.

Arthur Cronquist (personal communication) stated that many plants of northeastern *S. juncea* also exhibit rhizomes (both the filiform type and ones that are much stouter); these are deep-seated and usually escape collection. In southern *S. juncea* I have collected, the rhizomes are easily broken off, giving the impression that the specimen possesses none. Thus, a few plants of the series below appear to lack rhizomes. Nevertheless, most plants from each site have them. Voucher specimens are: *SOLIDAGO JUNCEA*. TENNESSEE: Bradley Co., *Morton 4425*. ALABAMA: Jackson Co., *Morton 4415* (only basal rosette), *4473*. GEORGIA: Whitfield Co., *Morton 4424* (all above dup. det. A. Cronquist; GA, NY, TENN). ILLINOIS: Alexander Co., *Morton 5119* (NY, SMU).

When identifying *S. juncea* or *S. missouriensis* one should be careful in using Fernald's key (*Gray's Manual of Botany*, 8th ed., 1950) because rhizomes seem much more prevalent in *S. juncea* than he supposed. Cronquist's (Gleason and Cronquist, *Manual of the vascular plants of northeastern United States and adjacent Canada*, 1963) use of leaf shape and venation

pattern better distinguishes the two: *S. juncea* has leaves scarcely or not at all triple-nerved and 2-7.5 cm wide, while *S. missouriensis* has leaves more or less strongly triple-nerved, often less than 2 cm wide.

One chromosome count, $n=9$, was made for *S. juncea*, agreeing with other published counts for the species. The voucher is: ALABAMA: Jackson Co., *Morton 3366* (TENN).—*Gary H. Morton, New York Botanical Garden, Bronx, New York, 10458.*

DIRCA PALUSTRIS (THYMELAEACEAE): NEW TO LOUISIANA.—Nevling (Jour. Arnold Arb. 43:432. 1962) did not include Louisiana in the range of *Dirca palustris L.* In personal correspondence (1970) he indicated he was not aware of *D. palustris* having previously been collected from Louisiana. In Caldwell Parish I found a large population of this species covering several acres and scattered throughout two branches of a large valley in the drainage of Winn Branch 8 miles NNW of Columbia. In some places the plants formed extensive thickets.

Leatherwood is often viewed as a facultative calciphile. I have collected it on limestone cliffs in Sevier Co., Tenn. and Independence Co., Ark. In Caldwell Parish it occurs on sandy moist soil in forests of *Fagus grandifolia, Liriodendron tulipifera,* and various *Quercus.* It is most abundant on the floor of deep valleys but spreads up adjoining slopes. It flowers in late February and the fruits fall by late April. There is disagreement in literature about the fruit color. In Louisiana the mature fruits are greenish yellow, turning purple as they dry before or after falling.

The stems of leatherwood are very flexible; descriptions in literature often give the impression that the wood is pliable. However, the wood itself is extremely brittle; it is the bark that is pliable.

Voucher specimens (*Thomas et al. 12828*, 28 Feb 1969) are available for exchange and are on deposit at SMU and GH.—*R. Dale Thomas, Northeast Louisiana University, Monroe, Louisiana 71201.*

A NEW SPECIES OF FRANKENIA (FRANKENIACEAE) FROM GYPSEOUS SOIL OF NORTH CENTRAL MEXICO.—FRANKENIA **leverichii** Turner, sp. nov. Plantae perennes suffruticosae usque ad 3 dm altae. Caules parce ramosi farinosi. Rami oppositi basi fragiles pallide brunnei alibi griseo-virides ca. 1 mm diametro. Internodia 7-10 mm longa. Folia opposita obovata-elliptica vel elliptica 4-5 mm longa 1.0-1.5 mm lata apiculata basi attenuata supra minute pubescentia subtus farinosa margine revoluto. Petioli ca. 1 mm longi alati ciliati alis trans nodo confluentibus. Flores solitarii axillares pedicellis 2-3 mm longis bracteis 4 ca. 3 mm longis 1 mm latis. Calycis tubus manifeste 5-costatus 2-3 mm longus griseo-virides sed costae basi purpurescentes. Calycis lobi 5 ca. 1 mm longi. Petala 5 unguiculata oblanceolata pallide rosea apice erosa calycem 1.5 mm superantes. Petali dimidium inferum paginae ventralis squama lineari ligulari. Stamina saepe

6 (raro 12 verticillis hexandris primum visum univerticillata), Antherae 1 mm longae basifixae. Filamenta alata alis conspicuis membranaceis ca. 0.5 mm latis. Pistillum 6.5 mm altum. Styli rami 3 ca. 3 mm longi.

Sparingly branched suffruticose perennial to 3 dm high; stems branching oppositely, farinose, light brown and brittle below, grayish green above, ca. 1 mm in diameter; internodes 7-10 mm long; leaves opposite, obovate-elliptic to elliptic, apiculate, attenuate at the base, 4-5 mm long, 1.0-1.5 mm wide, margins revolute, the upper surface minutely pubescent, the lower surface farinose; petiole short, winged, ca. 1 mm long, with ciliate margin united with that of the opposite leaf; flowers solitary in the leaf axils on pedicels 2-3 mm long, subtended by four leaflike bracts 2-3 mm long and 1-2 mm wide; calyx tube strongly 5-ribbed, 2-3 mm long with 5 acute lobes 1 mm long, purplish on the ribs at the base, otherwise grayish green; petals 5, clawed, pale pink, oblanceolate, erose at the apex, exceeding the calyx by 1.5 mm, with a linear ligular scale on the lower half of the ventral surface; stamens mostly 6, but occasionally 12, 6 long (5 mm) and 6 short (4 mm), in 2 whorls of 6 each but appearing as a single whorl; anthers 1 mm long, basifixed, filaments with conspicuous membranous wings ca. 0-5 mm wide; pistil 6.5 mm high; ovary unilocular with 3 basally attached anatropous ovules, style branches 3, about half the length of the gynoecium, terminated by well-defined stigmatic lines.

HOLOTYPE (TEX): MEXICO: Nuevo León: 100 km NW of Monterrey. Perennial in gypseous soil. 3 Sept 1971. *J. D. Bacon, W. R. Leverich,* & *B. L. Turner 1076.* Isotypes to be distributed.

The species is found primarily on relatively barren gypseous hills and ridges dominated by two other gypsophilic endemics, *Coldenia* cf. *hispidissima* (Torr.) Gray, and *Haplopappus johnstonii* Blake. It also occurs along alluvial washes with a number of saliniferous species belonging to *Allenrolfea, Sesuvium, Suaeda,* and *Atriplex.*

Frankenia leverichii is apparently most closely related to *F. johnstonii* Correll, a recently described, white-flowered, shrubby species from southern Texas. The number of known species of *Frankenia* from North America has doubled in the last 2 decades (from 4 to 8); four of the most recently described are gypsophilic endemics of north central Mexico and adjacent Texas.

The species is named for Mr. William Richard Leverich, "quasi-hippie" and part-time graduate student in plant systematics at the University of Texas, who shared with me the pleasure of discovering this rare endemic. Actually, when it was first found, I could not believe we had chanced upon yet another new species in the genus, so I remarked with my usual enthusiastic abandon, "Richard, if this is new, I'll name it for you." The remark caught me off guard and I'm now honor-bound to deliver on the promise. I hope this act of commitment will encourage an otherwise too

relaxed student to get on with his doctoral study of *Isocoma*.

I am grateful to Dr. M. C. Johnston for the Latin description and to Mr.

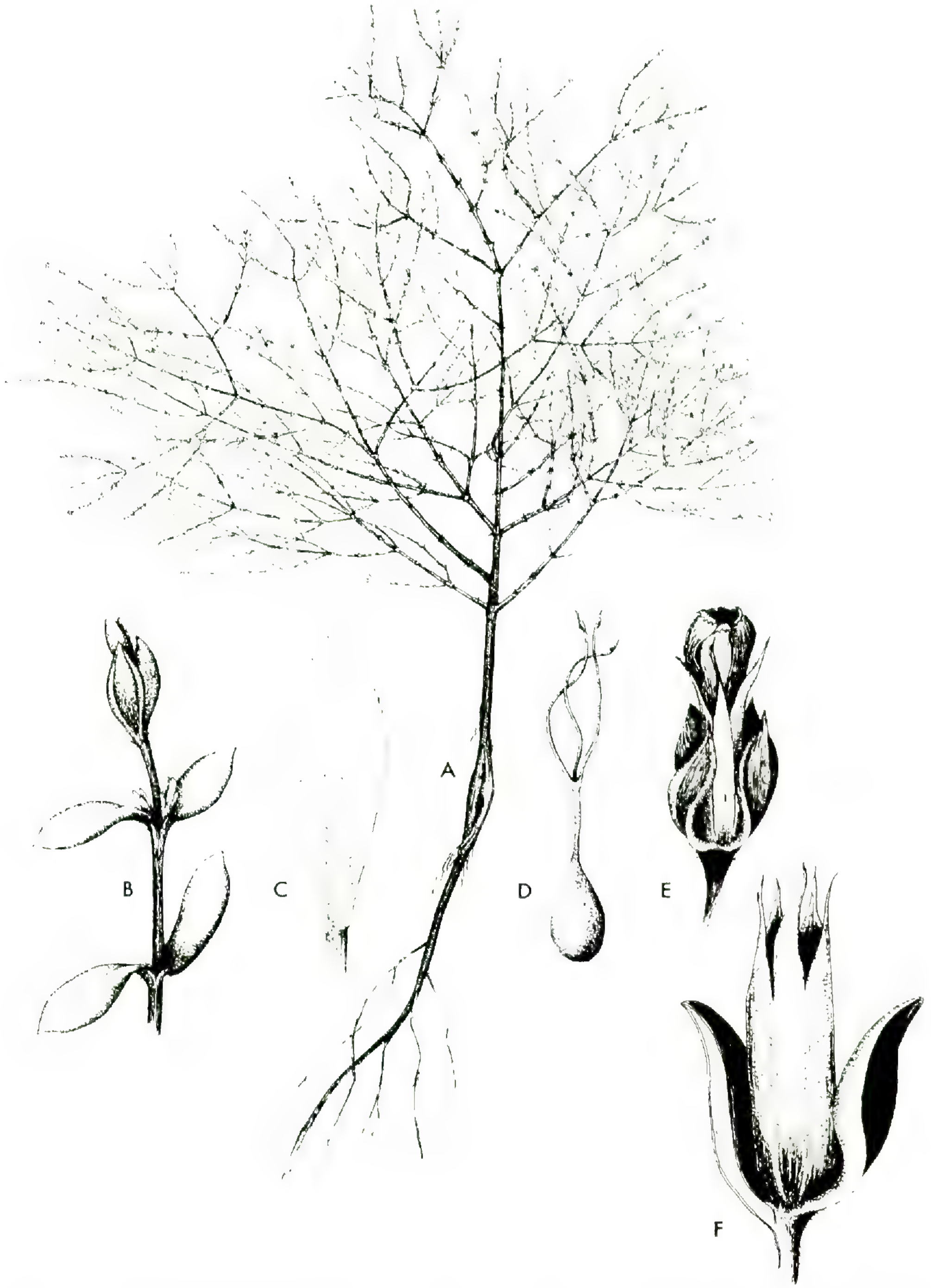

Fig. 1. *Frankenia leverichii*. A. Habit, X ½; B. Branch, X 3; C. Petal, X 9; D. Pistil, X 9; E. Bud, X 3; F. Fruiting calyx, X 10.

Geza Knipfer for the excellent line drawings. Field support for this study was provided in part by NSF grant 29576X.—*B. L. Turner, The University of Texas, Austin, Texas 78712.*

COMMENTS ON NEW MEXICO FLORA.—This is the first of an anticipated series of notes presenting new information on the flora of New Mexico. Specimens are deposited in the herbarium of New Mexico State University (NMC) and for *Silene plankii*, the University of Washington (WTU) and the New York Botanical Garden (NY), and *Perityle lemmoni* Sul Ross State University (SRSC). Discussion follows each entry.

Silene plankii Hitchc. & Maguire. Dona Ana County: crevices at base of sheer granite cliffs in box canyon, Long Canyon, Organ Mountains, *Todsen 700802* (2 August 1970), *Todsen 700815* (15 August 1970), *R & M Spellenberg & Todsen 2401* (25 September 1970). These are the first collections in New Mexico since Plank's original one in 1895. Correll collected *S. plankii* in the Franklin Mountains, El Paso County, Texas about 1965.

Heuchera sanguinea Engelm. Hidalgo County: base of rock face above Turkey Spring, Animas Mountains, *Todsen & Johnson* 25 September 1966. Previously reported only from southern Arizona in the US.

Polygala rimulicola Steyerm. Dona Ana County: appressed on NE limestone cliff faces in crevices, Black Mountain, southern San Andres Mountains at 5400 feet, *Todsen 2258*, 18 June 1972. Previously known only from the type locality in the Guadalupe Mountains of West Texas.

Eryngium lemmoni Coulter & Rose. Hidalgo County: open damp meadow near head of Cloverdale Creek, *Todsen* August 1972. Known only from SE Arizona.

Laphamia cernua Greene. Dona Ana County: NW granite seep face at the bottom of canyon, 1 mi W of Organ Peak, Fillmore Canyon, Organ Mountains, *Todsen* 4 July 1965; NE monzonite cliff face, Findley Canyon, Organ Mountains, *Todsen* July 1970; base of overhanging granite cliff, ½ mi E of Fillmore Spring, Fillmore Canyon, Organ Mountains, *Todsen* 6 August 1970; under overhangs and on N and E cliff faces, Long Canyon, Organ Mountains, *Todsen* 15 August 1970. This narrow endemic had been collected three times previously, all from a single cliff face near Dripping Springs, Ice Canyon, Organ Mountains. These new locations assure that this species will not become extinct.

Perityle lemmoni (Gray) McBride. Hidalgo County: limestone cliffs in canyon at NE end of Big Hatchet Mountains, *Todsen 2001*, 28 August 1971. Known only from southern Arizona.

Senecio salignus DC. Hidalgo County: in sandy loam of creek bottom, Guadalupe Canyon, Johnson's Lower Ranch, *Todsen 9-11*, 23 February 1969. Reported only from southern Arizona in the US.—*Thomas K. Todsen, White Sands Missile Range, New Mexico 88002.*

NOTICES

XII INTERNATIONAL BOTANICAL CONGRESS: JUNE 23-30, 1975

The Closing Plenary Session of the XI International Botanical Congress held at Seattle, U.S.A., in 1969, accepted an invitation issued by the Academy of Sciences of the U.S.S.R. to convene the XII International Botanical Congress in the City of Leningrad in 1975. In 1971 the Organizing Committee was appointed: consisting of a chairman (A. L. Takhtajan); four vice-chairmen (A. A. Prokofiev, A. A. Theodorov, N. V. Tsitsin, A. A. Yatsenko-Khmelevsky); a secretary-general (O. V. Zalensky); a scientific secretary (N. S. Snigirevskaya); and a number of members at large. The XII International Botanical Congress is intended to facilitate interdisciplinary communication among botanists as well as an informal exchange of ideas. A number of sections are planned, including special ones to accommodate mycologists (also lichenologists), phycologists, and bryologists.

The Congress will be divided between organized half-day symposia and half-day contributed paper sessions. In addition to the opening and closing plenary sessions, two evening lectures are being scheduled. All special interest groups wishing to apply for space and time during the Congress should do so by writing as soon as possible to the secretary-general, Dr. Oleg Zalensky, Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R., 2, Prof. Popov Street, Leningrad 197022, U.S.S.R.

The sessions of the Nomenclature Section will take place, as usual, immediately before the opening of the Congress— in this instance June 20-23. Four days are set aside in order to enable the Section to convene for six to eight sessions of two to four hours each.

A meeting of the International Association of Botanic Gardens (President Acadmician N.V. Tsitsin) will be held in Moscow at the Main Botanical Garden of the Academy of Sciences of the U.S.S.R. on June 20.

A tentative schedule of scientific field trips has been planned for the immediate pre-Congress and post-Congress periods. The principle purpose of these trips is to acquaint visiting botanists with as many interesting and unique features of the flora and vegetation of various regions of the U.S.S.R. as possible. Some specialized trips for phycologists, lichenologists, bryologists, and palaeobotanists are also planned.

The double postcards announcing the XII International Botanical Congress will be mailed during the last months of 1972. Those who wish to receive further information on the Congress should return their interest cards by March 1, 1973, so that they will be placed on the mailing list for the First Information Circular expected to be published June-July 1973.—*A. Takhtajan, Chairman, Organizing Committee.*

INTERNATIONAL CHECKLIST OF CULTIVATED ILEX, Part I (Contribution 3, U.S. National Arboretum). Available without cost from the International Checklist Committee for Cultivated *Ilex*, U. S. National Arboretum, Washington, D.C. 20002 or the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

SIDA CONTRIBUTIONS TO BOTANY

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SIDA, founded by Lloyd H. Shinners, is privately published by Wm. F. Mahler, SMU Herbarium, Dallas, Texas, 75275, U.S.A. Subscriptions: Libraries—$6.00 (U.S.) per year; individuals—$8.00 (U.S.) per volume; numbers issued twice a year.

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SIDA Contributions to Botany, Volume 5 Number 3, pages 137—190.

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GUIDE TO THE BOTANICAL CONTRIBUTIONS OF LLOYD H. SHINNERS (1918-1971)

JERRY M. FLOOK
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The career of Lloyd H. Shinners in taxonomic botany was, despite its relative brevity, a highly productive one. In addition to his master's thesis and his doctoral dissertation, he authored 276 articles and a 514-page flora of the north-central Texas area. These publications contain 558 new names and combinations. In an effort to make this volume of information more readily accessible, I have compiled a bibliography of Shinners' publications, catalogued his new names and combinations, indexed the generic names appearing in his writings, and cited published tributes to Shinners. It is hoped that this assemblage will in some measure facilitate literature research by students of the North American flora.

PUBLICATIONS

The publications of Lloyd H. Shinners are arranged as nearly as possible in chronological order. Years given are those borne by publications but do not necessarily agree with actual dates of distribution of the publications.

1940a. *Aristida basiramea* and its relatives. Am. Midl. Nat. 23: 633-634.

1940b. Notes on Wisconsin grasses—I. Additions to the grass flora. Am. Midl. Nat. 14: 757-760.

1941a. Studies of Wisconsin Compositae. M.A. thesis, Univ. of Wisc. pp. i-iii, 1-51, 51 maps.

1941b. *Epilobium paniculatum* var. *subulatum* in Wisconsin. Rhodora 43: 335.

1941c. Notes on Wisconsin grasses—II. *Muhlenbergia* and *Sporobolus*. Am. Midl. Nat. 26: 69-73.

1941d. The genus *Aster* in Wisconsin. Am. Midl. Nat. 26: 398-420.

1942. The status of *Aster longulus* Sheldon. Rhodora 44: 338-339.

1943a. A revision of the *Liatris scariosa* complex. Am. Midl. Nat. 29: 27-41.

1943b. The grasses of Wisconsin. Ph.D. dissertation, Univ. of Wisc. pp. i-iii, 1-68, 181 maps.

1943c. Notes on Wisconsin grasses—III. *Agrostis, Calamagrostis, Calamovilfa.* Am. Midl. Nat. 29: 779-782.

1943d. The genus *Aster* in Nova Scotia. Rhodora 45: 344-351.

1944a. *Aster acadiensis* nom. nov. Rhodora 46: 31.

1944b. Notes on Wisconsin grasses—IV. *Leptoloma* and *Panicum*. Am. Midl. Nat. 32: 164-180.

1945. The genus *Aster* in West Virginia. Castanea 10: 61-74.

1946a. Revision of the genus *Chaetopappus* DC. Wrightia 1: 63-81.

1946b. Revision of the genus *Leucelene* Greene. Wrightia 1: 82-89.

1946c. The genus *Dichaetophora* A. Gray and its relationships. Wrightia

1: 90-94.
1946d. Revision of the genus *Aphanostephus* DC. Wrightia 1: 95-121.
1946e. Revision of the genus *Kuhnia* L. Wrightia 1: 122-144.
1946f. Foreword. A supplementary gazetteer of Texas, 1875-1895, by Bessie Teeple Geiser. Field & Lab. 14: 88-89.
1947a. Two anomalous new species of *Erigeron* L. from Texas. Wrightia 1: 183-186.
1947b. Revision of the genus *Krigia* Schreber. Wrightia 1: 187-206.
1948a. The vetches and pea vines (*Vicia* and *Lathyrus*) of Texas. Field & Lab. 16: 18-29.
1948b. A new species of *Chrysopsis* Nuttall from the driftless area of Wisconsin. Wrightia 1: 218-219.
1948c. Geographic limits of some alien weeds in Texas. Tex. Geogr. Mag. 12(1): 16-25, pl. 1-2.
1949a. Nomenclature of species of dandelion and goatsbeard (*Taraxacum* and *Tragopogon*) introduced into Texas. Field & Lab. 17: 13-19.
1949b. Notes on Texas Compositae—I. Field & Lab. 17: 23-30.
1949c. Notes on Texas Compositae—II. Field & Lab. 17: 53-64.
1949d. Early plant collection returns to Texas. Field & Lab. 17: 66-68.
1949e. New names of Texas Chamaesyces. Field & Lab. 17: 69-70.
1949f. *Aster ontarionis* the same as *A. pantotrichus* (*A. missouriensis*). Rhodora 51: 89-91.
1949g. *Aster coerulescens* the same as *A. praealtus*. Rhodora 51: 91-92.
1949h. *Physostegia Correllii* (Lundell), comb. nov. Rhodora 51: 120-122.
1949i. Transfer of Texas species of *Petalostemum* to *Dalea* (Leguminosae). Field & Lab. 17: 81-85.
1949j. The genus *Dalea* (including *Petalostemum*) in North-central Texas. Field & Lab. 17: 85-89.
1949k. *Arenaria Drummondii* Shinners, nom. nov. Field & Lab. 17: 89.
1949l. *Delphinium virescens* Nutt. var. *Wootoni* (Rydb.) Shinners, comb. nov. Field & Lab. 17: 89.
1949m. *Asclepias tuberosa* L. var. *interior* (Woodson) Shinners, comb. nov. Field & Lab. 17: 89.
1949n. The Texas species of *Conyza* (Compositae). Field & Lab. 17: 142-144.
1949o. Nomenclature of Texas varieties of *Descurainia pinnata* (Cruciferae). Field & Lab. 17: 145.
1949p. Transfer of Texas species of *Houstonia* to *Hedyotis* (Rubiaceae). Field & Lab. 17: 166-169.
1949q. Notes on Texas Compositae—III. Field & Lab. 17: 170-176.
1949r. Revision of the genus *Egletes* Cassini north of South America. Lloydia 12: 239-247.
1949s. Two additions to the genus *Egletes* Cassini from northern South America. Lloydia 12: 248-250.
1950a. The Texas species of *Thelesperma* (Compositae). Field & Lab. 18: 17-24.

1950b. Notes on Texas Compositae—IV. Field & Lab. 18: 25-32.
1950c. Notes on Texas Compositae—V. Field & Lab. 18: 32-42.
1950d. *Parietaria pennsylvanica* Muhl. var. *obtusa* (Rydb.) Shinners, comb. nov. Field & Lab. 18: 42.
1950e. *Corydalis micrantha* var. *australis* (Chapm.) Shinners, comb. nov. Field & Lab. 18: 42.
1950f. The species of *Matelea* (including *Gonolobus*) in North Central Texas (Asclepiadaceae). Field & Lab. 18: 73-78.
1950g. The Texas species of *Cacalia* (Compositae). Field & Lab. 18: 79-83.
1950h. *Ranunculus carolinianus* DC. var. *villicaulis* Shinners, var. nov. Field & Lab. 18: 84.
1950i. Addenda on Texas *Thelesperma* (Compositae). Field & Lab. 18: 98-99.
1950j. *Forestiera pubescens* Nutt. var. *glabrifolia* Shinners, var. nov. Field & Lab. 18: 99-100.
1950k. *Hedyotis crassifolia* Raf. var. *micrantha* Shinners, var. nov. Field & Lab. 18: 100.
1950l. The North Texas species of *Plantago* (Plantaginaceae). Field & Lab. 18: 113-119.
1950m. *Centaurium calycosum* (Buckley) Fernald var. *breviflorum* Shinners, var. nov. Field & Lab. 18: 130.
1950n. *Gerardia tenuifolia* Vahl var. *leucanthera* (Raf.) Shinners, comb. nov. Field & Lab. 18: 130.
1950o. *Brassica Kaber* (DC.) Wheeler var. *stricta* (Celakovsky) Shinners, comb. nov. Rhodora 52: 127-128.
1950p. Sidelights from zoology on botanical nomenclature. Rhodora 52: 156-160.
1950q. Notes on Texas Compositae—VI. Field & Lab. 18: 156-159.
1951a. The Texas species of *Psoralea* (Leguminosae). Field & Lab. 19: 14-25.
1951b. *Ceanothus herbaceus* Raf. for *C. ovatus*: a correction of name. Field & Lab. 19: 33-34.
1951c. Two new varieties of *Solidago* from North Texas. Field & Lab. 19: 34-35.
1951d. *Pinaropappus roseus* var. *foliosus* (Heller) Shinners, comb. nov. Field & Lab. 19: 48.
1951e. *Cynanchum barbigerum* (Scheele) Shinners, comb. nov. Field & Lab. 19: 65.
1951f. The North Texas species of *Heterotheca*, including *Chrysopsis* (Compositae). Field & Lab. 19: 66-71.
1951g. Notes on Texas Compositae—VII. Field & Lab. 19: 74-82.
1951h. *Rhus aromatica* Ait. var. *flabelliformis* Shinners, var. nov. Field & Lab. 19: 86-87.
1951i. The North Texas species of *Hymenocallis* (Amaryllidaceae). Field & Lab. 19: 102.
1951j. *Allium Fraseri* (M. Ownbey) Shinners, comb. nov. Field & Lab. 19: 104.

1951k. The Texas species of *Evax* (Compositae). Field & Lab. 19: 125-126.
1951l. *Hybanthus linearis* (Torr.) Shinners, comb. nov. Field & Lab. 19: 126.
1951m. *Amsonia repens* Shinners, sp. nov. Field & Lab. 19: 126-127.
1951n. *Phlox Drummondii* Hook. var. *McAllisteri* (Whitehouse) Shinners, comb. nov. Field & Lab. 19: 127.
1951o. Notes on Texas Compositae—VIII. Field & Lab. 19: 133-136.
1951p. The Texas species of *Euthamia* (Compositae). Field & Lab. 19: 137-138.
1951q. Two new Texas species of *Physostegia* (Labiatae). Field & Lab. 19: 166-168.
1951r. *Yucca Freemanii*, a new species from northeastern Texas. Field & Lab. 19: 168-171.
1951s. *Agave lata*, a new species from North Texas and Oklahoma. Field & Lab. 19: 171-173.
1951t. The North Texas species of *Mirabilis* (Nyctaginaceae). Field & Lab. 19: 173-182.
1951u. *Vitis mustangensis* Buckley var. *diversa* (L. H. Bailey) Shinners, comb. nov. Field & Lab. 19: 182.
1951v. *Tragia urticifolia* Michx. var. *texana* Shinners, var. nov. Field & Lab. 19: 183.
1951w. *Croton capitatus* Michx. var. *albinoides* (A.M. Ferguson) Shinners, comb. nov. Field & Lab. 19: 183.
1951x. *Croton glandulosus* L. var. *hirsutus* Shinners, var. nov. Field & Lab. 19: 183.
1952a. Addenda on Texas *Chamaesyce* (Euphorbiaceae). Field & Lab. 20: 24-26.
1952b. *Cakile lanceolata* (Willd.) O. E. Schultz var. *geniculata* (B. L. Robinson) Shinners, comb. nov. Field & Lab. 20: 33-34.
1952c. *Cyperus globulosus* Aubl. var. *robustus* (Boeck.) Shinners, comb. nov. Field & Lab. 20: 34.
1952d. *Eragrostis oxylepis* Torr. var. *Beyrichii* (J. G. Smith) Shinners, comb. nov. Field & Lab. 20: 34.
1952e. The Texas species of *Palafoxia* (Compositae). Field & Lab. 20: 92-102.
1952f. *Cynanchum Grayi* Shinners, nom. nov. Field & Lab. 20: 110.
1953a. Synopsis of the United States species of *Lythrum* (Lythraceae). Field & Lab. 21: 80-89.
1953b. Nomenclature of the varieties of *Monarda punctata* L. (Labiatae). Field & Lab. 21: 89-92.
1953c. *Salvia farinacea* Benth. var. *latifolia* Shinners, var. nov. Field & Lab. 21: 92.
1953d. *Valerianella florifera* Shinners, sp. nov. Field & Lab. 21: 93.
1953e. *Pyrrhopappus georgianus* Shinners, sp. nov. Field & Lab. 21: 93-94.
1953f. *Sida ciliaris* L. var. *mexicana* (Moricand) Shinners, comb. nov. Field & Lab. 21: 94.
1953g. *Filago arvensis* in Michigan: a second North American record. Rho-

dora 55: 228.
1953h. Prairie variety of *Solidago gigantea*. Rhodora 55: 322.
1953i. The bluebonnets (*Lupinus*) of Texas. Field & Lab. 21: 149-153.
1953j. Synopsis of the genus *Brazoria* (Labiatae). Field & Lab. 21: 153-154.
1953k. Notes on Texas Compositae—IX. Field & Lab. 21: 155-162.
1953l. *Allium lavendulare* J. M. Bates var. *Fraseri* (M. Ownbey) Shinners, comb. nov. Field & Lab. 21: 164.
1953m. *Dalea laxiflora* Pursh var. *pumila* Shinners, var. nov. Field & Lab. 21: 164.
1953n. *Ipomoea trichocarpa* Ell. var. *Torreyana* (Gray) Shinners, comb. nov. Field & Lab. 21: 164-165.
1953o. *Dalea Helleri* Shinners, nom. nov. Field & Lab. 21: 165.
1953p. *Ruellia nudiflora* (Engelm. and Gray) Urban var. *hispidula* Shinners, var. nov. Field & Lab. 21: 165.
1954a. George L. Fisher (1868-1953). Field & Lab. 22: 24-26.
1954b. *Rubus duplaris*, a new species from northeastern Texas. Field & Lab. 22: 27-30.
1954c. *Carex caroliniana* Schwein. var. *cuspidata* (Dewey) Shinners, comb. nov. Field & Lab. 22: 30.
1954d. *Cyperus virens* Michx. var. *arenicola* (Steudel) Shinners, comb. nov. Field & Lab. 22: 30.
1954e. *Trifolium glomeratum* L. in Texas. Leafl. West. Bot. 7: 132.
1954f. Notes on North Texas grasses. Rhodora 56: 25-38.
1954g. George L. Fisher (1867-1953). Taxon 3: 93.
1954h. *Asclepias asperula* (Decaisne) Woodson var. *decumbens* (Nutt.) Shinners, comb. nov. Field & Lab. 22: 58.
1954i. *Eriogonum vespinum* (Polygonaceae) a new species from Texas. Field & Lab. 22: 68-69.
1954j. Southwest desert plants. (Review. Trees and Shrubs of the Southwestern Deserts, by Benson and Darrow.) Southwest Review 39: 280-281.
1955a. Botany in the Graduate Record Examination. (Letter to the Editor.) AIBS Bull. 5(2): 12-13.
1955b. Botany in the Graduate Record Examination. Field & Lab. 23: 12-14.
1955c. The Texas species of *Potentilla* (Rosaceae). Field & Lab. 23: 19-20.
1955d. *Heteranthera Liebmannii* (Buchenau) Shinners, comb. nov. Field & Lab. 23: 21.
1955e. Notes on Compositae—X. Field & Lab. 23: 34-36.
1955f. *Crepis pulchra* (Compositae) in northeastern Texas. Field & Lab. 23: 44.
1955g. Non-validity of Nuttallian names in Fraser's *Catalogue*. Rhodora 57: 290-293.
1955h. Tower of ivy. Mustang (Southern Methodist Univ.) Nov. 1955: 15-17.
1955i. Technical name for the Polyantha rose. Baileya 3: 171.
1955j. François Crépin on botanizing. Asa Gray Bull. II. 3: 65-76.

1956a. Authorship and nomenclature of bur clovers (*Medicago*) found wild in the United States. Rhodora 58: 1-13.

1956b. Illegitimacy of Persoon's species of *Koeleria* (Gramineae). Rhodora 58: 93-96.

1956c. *Pseudotsuga* and pseudo-science. Taxon 5: 43-46.

1956d. Review. The Ontario Field Biologist. Southwest. Nat. 1: 42-43.

1956e. Review. Vascular Plants of Illinois, by Jones and Fuller. Southwest. Nat. 1: 44-47.

1956f. *Physostegia serotina* (Labiatae), a new species from coastal Louisiana and Texas. Field & Lab. 24: 17-19.

1956g. *Zanthoxylon parvum* (Rutaceae), a new species from Trans-Pecos Texas. Field & Lab. 24: 19-20.

1956h. *Yucca louisianensis* Trel. var. *paniculata* (McKelvey) Shinners, comb. nov. Field & Lab. 24: 37.

1956i. *Quercus Shumardii* Buckley var. *microcarpa* (Torr.) Shinners, comb. nov. Field & Lab. 24: 37.

1956j. *Tragia Smallii* Shinners, sp. nov. Field & Lab. 24: 37.

1956k. *Euthamia pulverulenta* Greene (Compositae) in southwestern Louisiana. Field & Lab. 24: 38.

1956l. *Chamaesyce perennans* Shinners, sp. nov. Field & Lab. 24: 38.

1956m. *Argythamnia mercurialina* (Nutt.) Muell.-Arg. var. *pilosissima* (Benth.) Shinners, comb. nov. Field & Lab. 24: 38.

1956n. *Alchemilla microcarpa* Boissier & Reuter (Rosaceae) in Texas. Field & Lab. 24: 38-39.

1956o. Yellow-flowered *Oxalis* (Oxalidaceae) of eastern Texas and Louisiana. Field & Lab. 24: 39-40.

1956p. Technical names for the cultivated Capsicum peppers. Baileya 4: 81-83.

1956q. *Elodea* correct without being conserved. Rhodora 58: 162.

1956r. *Cenchrus parviceps* (Gramineae), a new species from southern Texas. Field & Lab. 24: 73-74.

1956s. *Andropogon Ischaemum* L. var. *songaricus* Ruprecht: technical name for King Ranch bluestem. Field & Lab. 24: 101-103.

1956t. The Texas species of *Limoniun* (Plumbaginaceae). Field & Lab. 24: 105-106.

1956u. Phylogeny in five dimensions. Given at Mo. Bot. Gard. 3rd Annual Symposium on Phylogeny and Taxonomy, St. Louis, 27 Oct. 1956. 4 pp. (mimeographed).

1956v. Nuttall not the author of Fraser's *Catalogue*. Rhodora 58: 281-289.

1956w. *Medicago polymorpha* var. *vulgaris*. Rhodora 58: 310.

1956x. Illegitimacy of the name *Sorghum vulgare* Persoon. Baileya 4: 141-142.

1956aa. *Forestiera autumnalis* Buckley (Oleaceae) in eastern Texas and western Louisiana. Southwest. Nat. 1: 87-88.

1956bb. *Hypochoeris glabra* L. (Compositae) in Arkansas and Louisiana.

Southwest Nat. 1: 88.
1956cc. Wind a factor in floral ecology and morphology. Southwest. Nat. 1: 88-89.
1956dd. Review. Review of the Nearctic *Viburnum*, by W. L. McAtee. Southwest. Nat. 1: 90-91.
1956ee. Review. Career Opportunities in Biology, by R. B. Stephens. Southwest Nat. 1: 93-95.
1956ff. Review. Flowers and Their Histories, by Alice Coats. Southwest. Nat. 1: 142-144.
1957a. *Wahlenbergia marginata* (Thunb.) A. DC. (Campanulaceae) in Louisiana. Southwest. Nat. 2: 44.
1957b. *Allium acetabulum* (Raf.) Shinners, comb. nov. Field & Lab. 25: 31-32.
1957c. *Linum imbricatum* (Raf.) Shinners, comb. nov. Field & Lab. 25: 32.
1957d. *Cayaponia quinqueloba* (Raf.) Shinners, comb. nov. Field & Lab. 25: 32.
1957e. Three new names for North Texas *Astragalus* (Leguminosae). Field & Lab. 25: 33.
1957f. Against conservation of *Xanthoxylem* and *Pherosphaera*. Taxon 6: 135-137.
1957g. *Sisyrinchium Bermudianum* L. instead of *S. angustifolium* Miller. Rhodora 59: 159-160.
1957h. Translation and commentary. Salt cedars (*Tamarix*, Tamaricaceae) of the Soviet Union, by S. G. Gorschkova. Southwest. Nat. 2: 48-73.
1957i. Scarcity of wild bees and wasps (Hymenoptera, Aculeata) in North Central Texas in 1957. Southwest. Nat. 2: 129-131.
1957j. Anthophorid behavior of a honeybee, *Apis mellifera* (Hymenoptera, Apoidea). Southwest, Nat. 2: 131-132.
1957k. François Crépin on botanizing. Field & Lab. 25: 65-78.
1957l. *Dianthera americana* L. var. *subcoriacea* (Fernald) Shinners, comb. nov. Field & Lab. 25: 79-80.
1957m. A modest plea in favor of divers taxons. Rhodora 59: 235-237.
1957n. *Polygonum bicorne* Raf. instead of *P. longistylum* Small. Rhodora 59: 265-267.
1957o. Synopsis of the genus *Eustoma* (Gentianaceae). Southwest. Nat. 2: 38-43.
1958a. Spring Flora of the Dallas-Fort Worth Area, Texas. Published by author, Dallas, Texas. 514 pp.
1958b. New varietal names in *Argemone* (Papaveraceae). Southwest. Nat. 3: 213-214.
1958c. *Carduus nutans* L. (Compositae), a European thistle in northwestern Louisiana. Southwest. Nat. 3: 220.
1958d. *Carthamus lanatus* L. var. *baeticus* (Boissier & Reuter) P. Coutinho (Compositae): another introduced thistle in Central Texas. Southwest. Nat. 3: 220.

1958e. *Arabidopsis thaliana* (L.) Heynhold (Cruciferae) introduced in northeastern Texas. Southwest. Nat. 3: 213.

1959a. *Hymenopappus filifolius* var. *alpestris* (Maguire) Shinners comb. nov. Rhodora 61: 155.

1959b. Typification of the genus *Forestiera* (Oleaceae). Rhodora 61: 293-294.

1959c. Species of *Laphamia* transferred to *Perityle* (Compositae-Heleniceae). Southwest. Nat. 4: 204-206.

1959d. *Liatris tenuis* n. sp. (Compositae), another endemic in southeastern Texas. Southwest. Nat. 4: 207-208.

1959e. Species of *Berendtia* Gray (Scrophulariaceae: not Goeppert, fossil Myrsinaceae) transferred to *Berendtiella*. Southwest. Nat. 4: 208-209.

1960. *Ranunculus trilobus* (Ranunculaceae) in southern Louisiana: new to the United States. Southwest. Nat. 5: 170.

1961a. *Phlox bifida* var. *induta* (Polemoniaceae), a new endemic in North Central Texas. Southwest. Nat. 6: 50-51.

1961b. *Ipomoea Shumardiana* (Convolvulaceae), a neglected Oklahoma-North Texas endemic. Southwest. Nat. 6: 100-101.

1961c. *Tragia nepetaefolia* var. *leptophylla* instead of var. *ramosa* (Euphorbiaceae). Southwest. Nat. 6: 101.

1961d. Nomenclature of Bignoniaceae of the southern United States. Castanea 26: 109-118.

1961e. *Rhododendron Coryi* (Ericaceae), a new repent species from southeastern Texas. Castanea 26: 156-157.

1961f. *Viola Rafinesquii*: nomenclature and native status. Rhodora 63: 327-335.

1962a. Illegitimacy of the names *Iresine celosia* L., I. *celosioides* L., and *I. paniculata* (L.) Kuntze (Amaranthaceae). Taxon 11: 141-142.

1962b. Legitimacy of the name *Ipomoea trichocarpa* Elliott (Convolvulaceae). Taxon 11: 142.

1962c. *Hyptis radiata* (Labiatae) an illegitimate name. Rhodora 64: 184-186.

1962d. Synopsis of United States *Bonamia*, including *Breweria* and *Stylisma* (Convolvulaceae). Castanea 27: 65-77.

1962e. Three new *Gerardia* names under *Agalinis*, nom. conservandum (Scrophulariaceae). Castanea 27: 87-88.

1962f. *Rhododendron nudiflorum* and *R. roseum* (Ericaceae): illegitimate names. Castanea 27: 94-95.

1962g. *Mazus reptans* (Scrophulariaceae) in Maryland. Rhodora 64: 229-231.

1962h. *Salpichroa origanifolia* instead of S. *rhomboidea* (Solanaceae). Leafl. West. Bot. 9: 257-259.

1962i. Evolution of the Gray's and Small's manual ranges. Sida 1: 1-31.

1962j. Annual Sisyrinchiums (Iridaceae) in the United States. Sida 1: 32-42.

1962k. New names in *Arenaria* (Caryophyllaceae). Sida 1: 49-52.

1962l. *Drosera* (Droseraceae) in the southeastern United States: an interim report. Sida 1: 53-59.

1962m. Key to southeastern glabrous-styled *Tephrosia* (Leguminosae). Sida

1: 60-62.

1962n. *Calamintha* (Labiatae) in the southern United States. Sida 1: 69-75.

1962o. Synopsis of *Collinsonia* (Labiatae). Sida 1: 76-83.

1962p. Synopsis of *Conradina* (Labiatae). Sida 1: 84-88.

1962q. Synopsis of *Dicerandra* (Labiatae). Sida 1: 89-91.

1962r. Vegetative key to the woody Labiatae of the southeastern coastal plain. Sida 1: 92-93.

1962s. *Micromeria Brownei* and its allies (Labiatae). Sida 1: 94-97.

1962t. Weed transport in St. Augustine grass sod in Texas. Sida 1: 98-99.

1962u. *Eichhornia azurea* (Pontederiaceae) in the Texas Coastal Bend: new to the United States. Sida 1: 99.

1962v. *Aneilema* (Commelinaceae) in the United States. Sida 1: 100-101.

1962w. *Siphonychia* transferred to *Paronychia* (Caryophyllaceae). Sida 1: 101-103.

1962x. *Stellaria Corei* Shinners, nom. nov. (Caryophyllaceae). Sida 1: 103-104.

1962y. *Ranunculus trachycarpus* (Ranunculaceae) in south central Louisiana: new to North America. Sida 1: 104-105.

1962z. *Warea auriculata* instead of *W. amplexifolia* of Small (Cruciferae). Sida 1: 105-106.

1962aa. *Wissadula grandifolia* instead of *W. macrantha* (Malvaceae): nomenclatural corrections. Sida 1: 106-107.

1962bb. *Gentiana DeLoachii* (W. P. Lemmon) Shinners, comb. nov. (Gentianaceae). Sida 1: 107.

1962cc. *Agastache breviflora* (Gray) Epling var. *Havardii* (Gray) Shinners, comb. nov. (Labiatae), Sida 1: 107.

1962dd. *Scutellaria laevis* (Labiatae), another endemic in Trans-Pecos Texas. Sida 1: 107-108.

1962ee. *Solanum Godfreyi* Shinners, nom. nov. (Solanaceae). Sida 1: 108.

1963a. Southeastern records of *Stachys affinis* (*S. Sieboldii*) and *S. floridana* (Labiatae). Castanea 28: 44-46.

1963b. *Gilia* and *Ipomopsis* (Polemoniaceae) in Texas. Sida 1: 171-179.

1963c. *Leptoglossis* and *Nierembergia* (Solanaceae) in Texas. Sida 1: 180-181.

1963d. The varieties of *Teucrium canadense* (Labiatae). Sida 1: 182-183.

1964a. *Amaranthus microphyllus* Shinners, sp. nov. (Amaranthaceae). Sida 1: 248-249.

1964b. *Scutellaria Thieretii* (Labiatae), a new species from coastal Louisiana. Sida 1: 251-252.

1964c. *Micranthemum glomeratum* (Chapman) Shinners, comb. nov. (Scrophulariaceae). Sida 1: 252.

1964d. Texas *Evax* transferred to *Filago* (Compositae). Sida 1: 252-253.

1964e. *Verbesina Walteri* Shinners, nom. nov. (Compositae). Sida 1: 253.

1964f. Review. Flora of Henry County, Illinois, an Annotated List of the Vascular Plants, by R. J. Dobbs. Sida 1: 254-256.

1964g. How to study the Florida flora. Sida 1: 257-261.

1964h. *Tigridia purpurea* (Herbert) Shinners, comb. nov. (Iridaceae). Sida 1: 295.

1964i. *Machaeranthera pinnatifida* (Hooker) Shinners, comb. nov. (Compositae). Sida 1: 295.

1964j. Review. Roadside Flowers of Texas, by Wills and Irwin. Sida 1: 296-298.

1964k. Application of the name *Kuhnia eupatorioides* var. *angustifolia* (Compositae). Rhodora 66: 160.

1964l. *Calylophus* (*Oenothera* in part: Onagraceae) in Texas. Sida 1: 337-345.

1964m. Texas Asclepiadaceae other than *Asclepias*. Sida 1: 358-367.

1964n. New names and records for Texas Compositae. Sida 1: 373-379.

1964o. *Digitaria Ischaemum* (Gramineae) in Mississippi and Texas. Sida 1: 380-381.

1964p. *Cayratia japonica* (Vitaceae) in southeastern Louisiana; new in the United States. Sida 1: 384.

1964q. Three new varietal names in *Sphaeralcea* (Malvaceae). Sida 1: 384-385.

1964r. New varietal names for New World *Ludwigia* (Onagraceae). Sida 1: 385-386.

1964s. Two Youngias ("*Crepis japonica*": Compositae) introduced in the southeastern United States. Sida 1: 386-388.

1965a. Correct nomenclature of two Mexican narcotic plants. Taxon 14: 103-105.

1965b. *Ipomoea lacunosa* (Convolvulaceae). Leafl. West. Bot. 10: 162.

1965c. *Ipomoea amnicola* (Convolvulaceae), a South American waif in Missouri. Rhodora 67: 200.

1965d. Untypification for *Ipomoea nil* (L.) Roth. Taxon 14: 231-234.

1965e. *Holosteum umbellatum* (Caryophyllaceae) in the United States: population explosion and fractionated suicide. Sida 2: 119-128.

1965f. *Cynanchum angustifolium* Persoon instead of *C. palustre* (Asclepiadaceae). Sida 2: 174.

1965g. *Ipomoea* × *multifida* (Rafinesque) Shinners, comb. nov. (Convolvulaceae). Sida 2: 265.

1965h. Bees and flowers. Given at Seventh Bee Pollination Conference, Texas A&M Univ., College Station, Tex., 29 Oct 1965.

1966a. *Verbena pulchella* Sweet var. *gracilior* (Troncoso) Shinners, comb. nov. Sida 2: 266.

1966b. Texas *Polianthes*, including *Manfreda* (*Agave* subgenus *Manfreda*) and *Runyonia* (Agavaceae). Sida 2: 333-338.

1966c. *Astranthium integrifolium* var. *triflorum* (Rafinesque) Shinners, comb. nov. (Compositae). Sida 2: 348.

1966d. *Thelesperma filifolium* var. *intermedium* (Rydberg) Shinners, comb. nov. (Compositae). Sida 2: 348.

1966e. *Cerastium glutinosum* Fries (Caryophyllaceae) in Mississippi: new to

North America. Sida 2: 392-393.

1966f. *Hypochoeris microcephala* var. *albiflora* (Compositae) in southeastern Texas: new to North America. Sida 2: 393-394.

1967a. *Brunnichia ovata* (Walter) Shinners, comb. nov. (Polygonaceae). Sida 3: 115.

1967b. Species of *Bilderdykia* (*Tiniaria*, *Polygonum* in part) transferred to *Reynoutria* (Polygonaceae). Sida 3: 117-118.

1967c. Stray notes on Texas *Plantago* (Plantaginaceae). Sida 3: 120-122.

1967d. *Tessaria sericea* (Nuttall) Shinners, comb. nov. (Compositae). Sida 3: 122.

1967e. *Polianthes Rosei* Shinners, nom. nov. (Agavaceae). Sida 3: 183.

1967f. *Bupleurum lancifolium* (*B. subovatum*) (Umbelliferae) in Texas. Sida 3: 185.

1968a. *Calystegia sepium* var. *fraterniflora* (Mackenzie & Bush) Shinners, comb. nov. (Convolvulaceae). Sida 3: 282.

and Rogers McVaugh. 1968b. Proposal to add *Kuhnia* Linnaeus (1763) as a nomen rejiciendum versus 8823, *Brickellia* Elliott, nom. cons. Taxon 17: 732-734.

1969a. Local floras: past, present, and future. Taxon 18: 167-176.

1969b. *Petrorhagia prolifera* (*Dianthus prolifer*, *Tunica prolifera*) (Caryophyllaceae) in Arkansas and Texas. Sida 3: 345-346.

1969c. *Chamaesyce jejuna* (Johnston & Warnock) Shinners, comb. nov. (Euphorbiaceae). Sida 3: 347.

1969d. *Stylisma patens* var. *angustifolia* (Nash) Shinners, comb. nov. (Convolvulaceae). Sida 3: 347.

1969e. *Cryptantha Jamesii* var. *setosa* (M. E. Jones) Shinners, comb. nov. (Boraginaceae). Sida 3: 347.

1969f. *Heterotheca aspera* (Shuttleworth) Shinners, comb. nov. (Compositae). Sida 3: 348.

1969g. *Croptilon divaricatum* var. *graniticum* (E. B. Smith) Shinners, comb. nov. (Compositae). Sida 3: 348.

1969h. *Heleastrum Chapmanii* (T. & G.) Shinners, comb. nov. (Compositae). Sida 3: 348.

1971a. *Bigelowia nudata* var. *australis* (L. C. Anderson) Shinners, comb. nov. (Compositae). Sida 4: 274.

1971b. *Kuhnia* L. transferred to *Brickellia* Ell. (Compositae) Sida 4: 274.

1971c. *Teucrium cubense* Jacq. var. *laevigatum* (Vahl) Shinners, comb. nov. (Labiatae). Sida 4: 275.

1973. *Chloris truncata* R. Br. (Gramineae), an Australian wool-waste adventive in South Carolina. Sida 5: 182.

NEW NAMES AND COMBINATIONS

The new names and combinations authored by Lloyd H. Shinners are arranged alphabetically by genus, species, etc. Whenever possible, dates given are those of actual distribution of the publications. In cases in which issue

dates are not available the dates designated are those recorded in the Torrey Index. Type specimens are cited for the new taxa.

Agalinis maritima var. *grandiflora* (Benth.) Shinners, comb. nov. Castanea 27: 88. 12 Jul 1962.

Agalinis nuttallii Shinners, nom. nov. Castanea 27: 88. 12 Jul 1962.

Agalinis pseudaphylla (Penn.) Shinners, comb. nov. Castanea 27: 88. 12 Jul 1962.

Agastache breviflora (Gray) Epl. var. *havardii* (Gray) Shinners, comb. nov. Sida 1: 107. 23 Nov 1962.

Agave lata Shinners, sp. nov. Type: H. V. Daly 61 (SMU). Field & Lab. 19: 171-173. 15 Oct 1951.

Agrostis elliottiana Schult. f. *molesta* Shinners, f. nov. Type: L. H. Shinners 14372 (SMU). Rhodora 56: 28. 17 Mar 1954.

Allium acetabulum (Raf.) Shinners, comb. nov. Field & Lab. 25: 31-32. 15 Mar 1957.

Allium acetabulum (Raf.) Shinners var. *lavendulare* (Bates) Shinners, comb. nov. Field & Lab. 25: 32. 15 Mar 1957.

Allium fraseri (M. Ownbey) Shinners, comb. nov. Field & Lab. 19: 104. 1 Jun 1951.

Allium lavendulare Bates var. *fraseri* (M. Ownbey) Shinners, comb. nov. Field & Lab. 21: 164. 15 Feb 1954.

Amaranthus microphyllus Shinners, sp. nov. Type: U. T. Waterfall 6620 (SMU). Sida 1: 248-249. 25 Jun 1964.

Ambrosia caudata (Rydb.) Shinners, comb. nov. Field & Lab. 17: 174. 24 Oct 1949.

Ambrosia grayi (A. Nels.) Shinners, comb. nov. Field & Lab. 17: 174. 24 Oct 1949.

Ambrosia simulans Shinners, nom. nov. Field & Lab. 17: 173-174. 24 Oct 1949.

Amsonia repens Shinners, sp. nov. Type: V. L. Cory 55089 (SMU). Field & Lab. 19: 126-127. 24 Jul 1951.

Andropogon scoparius Michx. var. *virilis* Shinners, var. nov. Type: L. H. Shinners 16009 (SMU; isotype US). Rhodora 56: 36-37. 17 Mar 1954.

Aphanostephus jaliscensis Shinners, sp. nov. Type: C. G. Pringle 9440 (GH; isotype US). Wrightia 1: 115-116. 30 Apr 1946.

Aphanostephus pachyrrhizus Shinners, sp. nov. Type: C. A. Purpus 5627 (UC; isotypes GH, MO, US). Wrightia 1: 117-118. 30 Apr 1946.

Aphanostephus potosinus Shinners, sp. nov. Type: C. A. Purpus 5122 (UC; isotypes GH, MO, US). Wrightia 1: 108-109. 30 Apr 1946.

Aphanostephus skirrhobasis (DC.) Trel. f. *incisifolius* Shinners, f. nov. Type: L. H. Shinners 8010 (SMU). Wrightia 1: 103-106. 30 Apr 1946.

Aphanostephus skirrhobasis (DC.) Trel f. *quasigigantiusculus* Shinners, f. nov. Type L. H. Shinners 7104 (SMU). Wrightia 1: 103-106. 30 Apr 1946.

Aphanostephus skirrhobasis (DC.) Trel. var. *thalassius* Shinners, var. nov. Type: L. H. Shinners 7718 (SMU). Wrightia 1: 106-107. 30 Apr 1946.

Arenaria anomala (Waldstein & Kitaibel) Shinners, comb. nov. Sida 1: 50. 23 Nov 1962.

Arenaria argaea (Boissier & Balansa) Shinners, comb. nov. Sida 1: 50. 23 Nov 1962.

Arenaria drummondii Shinners, nom. nov. Field & Lab. 17: 89. 13 Jul 1949.

Arenaria fassettii Shinners, nom. nov. Sida 1: 51. 23 Nov 1962.

Arenaria fontinalis (Short & Peter) Shinners, comb. nov. Sida 1: 51. 23 Nov 1962.

Arenaria godfreyi Shinners, nom. nov. Sida 1: 51. 23 Nov 1962.

Arenaria iranica Shinners, nom. nov. Sida 1: 50. 23 Nov 1962.

Arenaria jamesiana (Torrey) Shinners, comb. nov. Sida 1: 50. 23 Nov 1962.

Arenaria kotschyi (Boissier) Shinners, comb. nov. Sida 1: 50. 23 Nov 1962.

Arenaria lanuginosa (Michx.) Rohrbach var. *cinerascens* (Robins.) Shinners, comb. nov. Sida 1: 50. 23 Nov 1962.

Arenaria ludens Shinners, sp. nov. Type: B. H. Warnock 7419 (SMU). Sida 1: 51. 23 Nov 1962.

Arenaria stephaniana (Willd.) Shinners, comb. nov. Sida 1: 50. 23 Nov 1962.

Arenaria stephaniana (Willd.) Shinners var. *americana* (Porter) Shinners, comb. nov. Sida 1: 50. 23 Nov 1962.

Arenaria trigyna (Vill.) Shinners, comb. nov. Sida 1: 51. 23 Nov 1962.

Argemone albiflora Hornem. var. *texana* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 214. 1 June 1959.

Argemone corymbosa Greene var. *arenicola* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 214. 1 Jun 1959.

Argemone grandiflora Sweet var. *armata* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 214. 1 Jun 1959.

Argemone munita Durand & Hilgard var. *argentea* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 213. 1 Jun 1959.

Argemone munita Durand & Hilgard var. *robusta* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 213. 1 Jun 1959.

Argemone munita Durand & Hilgard var. *rotundata* (Rydb.) Shinners, comb. nov. Southwest. Nat. 3: 213. 1 Jun 1959.

Argemone ochroleuca Sweet var. *stenopetala* (Prain) Shinners, comb. nov. Southwest. Nat. 3: 213. 1 Jun 1959.

Argemone pleiacantha Greene var. *ambigua* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 214. 1 Jun 1959.

Argemone pleiacantha Greene var. *pinnatisecta* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 214. 1 Jun 1959.

Argemone squarrosa Greene var. *glabrata* (G. Ownbey) Shinners, comb. nov. Southwest. Nat. 3: 213. 1 Jun 1959.

Argythamnia humilis (Engelm. & Gray) Muell.-Arg. var. *laevis* (Gray) Shinners, comb. nov. Field & Lab. 24: 38. 15 Jun 1956.

Argythamnia mercurialina (Nutt.) Muell.-Arg. var. *pilosissima* (Benth.) Shinners, comb. nov. Field & Lab. 24: 38. 15 Jun 1956.

Aristida basiramea Engelm. var. *curtissii* (Gray) Shinners, comb. nov. Am.

Midl. Nat. 23: 633. 26 Jun 1949.

Aristida dichotoma Michx. f. *major* Shinners, f. nov. Type: T. H. Kearney, s. n., 27 Sep 1896 (GH). Am. Midl. Nat. 23: 634. 26 Jun 1940.

Aristida necopina Shinners, sp. nov. Type: V. H. Chase 5302 (SMU). Rhodora 56: 30. 17 Mar 1954.

Artemisia ludoviciana Nutt. var. *albula* (Woot.) Shinners, comb. nov. Sida 1: 374. 30 Oct 1964.

Artemisia ludoviciana Nutt. var. *redolens* (Gray) Shinners, comb. nov. Sida 1: 374. 30 Oct 1964.

Asclepias asperula (Dene.) Woods. var. *decumbens* (Nutt.) Shinners, comb. nov. Field & Lab. 22: 58. Apr 1954.

Asclepias tuberosa L. var. *interior* (Woods.) Shinners, comb. nov. Field & Lab. 17: 89. 13 Jul 1949.

Asclepias tuberosa L. var. *rolfsii* (Britt.) Shinners, comb. nov. Field & Lab. 17: 89. 13 Jul 1949.

Aster acadiensis Shinners, nom. nov. Rhodora 46: 31. 12 Feb 1944.

Aster cordifolius L. var. *moratus* (Shinners) Shinners, comb. nov. Castanea 10: 65-66. Oct 1945.

Aster eulae Shinners, sp. nov. Type: L. H. Shinners 12027 (SMU). Field & Lab. 18: 35-38. 2 Jan 1950.

Aster finkii Rybd. var. *moratus* Shinners, var. nov. Type: L. H. Shinners 3367 (WIS). Am. Midl. Nat. 26: 407-408. 30 Sep 1941.

Aster furcatus f. *elaciniatus* (Benke) Shinners, stat. nov. Am. Midl. Nat. 26: 405. 30 Sep 1941.

Aster laevis L. f. *latifolius* (Porter) Shinners, stat. nov. Am. Midl. Nat. 26: 409. 30 Sep 1941.

Aster laevis L. f. *purpurascens* (Farw.) Shinners, comb. nov. Am. Midl. Nat. 26: 409. 30 Sep 1941.

Aster lateriflorus (L.) Britt. var. *flagellaris* Shinners, var. nov. Type: L. H. Shinners 9589 (SMU). Field & Lab. 21: 157-158. 15 Feb 1954.

Aster lateriflorus (L.) Britt. var. *indutus* Shinners, var. nov. Type: E. Whitehouse 17641 (SMU). Field & Lab. 21: 158. 15 Feb 1954.

Aster macrophyllus f. *eglandulosus* Shinners, f. nov. Type: Monroe 11 (MIL). Am. Midl. Nat. 26: 405. 30 Sep 1941.

Aster oblongifolius Nutt. var. *angustatus* Shinners, var. nov. Type: Fassett, Catenhusen, & Shinners 20764 (WIS). Am. Midl. Nat. 26: 418. 30 Sep 1941.

Aster oblongifolius Nutt. var. *orientis* Shinners, var. nov. Type: W. V. U. Bot. Exped., 19 Aug 1929 (WVA). Castanea 10: 72. Oct 1945.

Aster oblongifolius Nutt. var. *orientis* Shinners f. *roseus* Shinners, f. nov. Type: Mr. & Mrs. H. A. Davis & E. L. Core, s. n. 24 Sep 1941 (WVA). Castanea 10: 72. Oct 1945.

Aster oblongifolius Nutt f. *roseoligulatus* (Benke) Shinners, comb. nov. Am. Midl. Nat. 26: 417-418. 30 Sep 1941.

Aster puniceus L. f. *albiflorus* (Farw.) Shinners, stat. nov. Am. Midl. Nat. 26: 414-415. 30 Sep 1941.

Aster puniceus L. var. *calvus* Shinners, var. nov. Type: H. A. Allard 9035 (WVA). Castanea 10: 71. Oct 1945.

Aster puniceus L. f. *colbyi* (Benke) Shinners, stat. nov. Am. Midl. Nat. 26: 414-415. 30 Sep 1941.

Aster puniceus L. f. *glabratus* Shinners, f. nov. Type: H. Cutler 316 (WIS). Am. Midl. Nat. 26: 414-415. 30 Sep 1941.

Aster rolandii Shinners, sp. nov. Type: A. R. Prince & C. E. Atwood 1456 (WIS). Rhodora 45: 346-347. 11 Sep 1943.

Aster sagittifolius Wedem. ex Willd. var. *drummondii* (Lindl.) Shinners, stat. nov. Am. Midl. Nat. 26: 406-407. Sep 1941.

Aster sagittifolius Wedem. ex Willd. f. *hirtellus* (Lindl.) Shinners, stat. nov. Am. Midl. Nat. 26: 406. 30 Sep 1941.

Aster scabricaulis Shinners, sp. nov. Type: L. H. Shinner 9504 (SMU). Field & Lab. 21: 156-157. 15 Feb 1954.

Aster shortii Lindl. f. *asper* Shinners, f. nov. Type: Fassett & Shinners 20708 (WIS). Am. Midl. Nat. 26: 408. 30 Sep 1941.

Aster steeleorum Shinners, sp. nov. Type: E. S. & Mrs. Steele 324 (GH). Castanea 10: 67-68. Oct 1945.

Aster subulatus Michx. var. *australis* (Gray) Shinners, comb. nov. Field & Lab. 21: 158-159. 15 Feb 1954.

Aster subulatus Michx. var. *cubensis* (DC.) Shinners, comb. nov. Field & Lab. 21: 161-162. 15 Feb 1954.

Aster subulatus Michx. var. *ligulatus* Shinners, var. nov. Type: L. H. Shinners 12057 (SMU). Field & Lab. 21: 159-160. 15 Feb 1954.

Aster tenuipes (Wieg.) Shinners, stat. nov. Rhodora 45: 345. 11 Sep 1943.

Aster texanus Burgess var. *parviceps* Shinners, var. nov. Type: E. Whitehouse 20503 (SMU). Field & Lab. 21: 156. 15 Feb 1954.

Aster virginiensis Shinners, sp. nov. Type: E. J. Grimes 4450 (GH). Castenea 10: 66-67. Oct 1945.

Astragalus austrinus (Small) Schulz var. *pleianthus* Shinners, var. nov. Type: L. H. Shinners 22900 (SMU). Field & Lab. 25: 33. 15 Mar 1957.

Astragalus lambertii (Pursh) Spreng. var. *abbreviatus* (Greene) Shinners, comb. nov. Field & Lab. 25: 33. 15 Mar 1957.

Astragalus lindheimeri Engelm. var. *bellus* Shinners, var. nov. Type: L. H. Shinners 18568 (SMU). Field & Lab. 25: 33. 15 Mar 1957.

Astranthium integrifolium (Michx.) Nutt. var. *robustum* Shinners, var. nov. Type: B. H. Warnock 5126 (SMU). Field & Lab. 18: 158. 11 Dec 1950.

Astranthium integrifolium var. *triflorum* (Raf.) Shinners, comb. nov. Sida 2: 348. 20 Jul 1966.

Berendtiella coulteri (Gray) Shinners, comb. nov. Southwest. Nat. 4: 208. 1 Dec 1959.

Berendtiella levigata (Robins. & Greenm.) Shinners, comb. nov. Southwest. Nat. 4: 209. 1 Dec 1959.

Berendtiella rugosa (Benth.) Shinners, comb. nov. Southwest. Nat. 4: 209. 1 Dec 1959.

Berendtiella spinulosa (Wats.) Shinners, comb. nov. Southwest. Nat. 4: 209. 1 Dec 1959.

Bigelowia nudata var. *australis* (L. C. Anderson) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Bonamia patens (Desr.) Shinners, comb. nov. Castanea 27: 74-75. 12 Jul 1962.

Bonamia patens (Desr.) Shinners var. *augustifolia* (Nash) Shinners, comb. nov. Castanea 27: 75. 12 Jul 1962.

Brassica kaber (DC.) Wheeler var. *stricta* (Celak.) Shinners, comb. nov. Rhodora 52: 127-128. 10 May 1950.

Brickellia adenolepis (Robins.) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia chlorolepis (Woot. & Standl.) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia eupatorioides (L.) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia leptophylla (Scheele) Shinners var. *mexicana* (Shinners) Shinners, comb. nov. Sida 4: 274. 2 Jul 1971.

Brickellia eupatorioides (L.) Shinners var. *ozarkana* (Shinners) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia eupatorioides (L.) Shinners var. *texana* (Shinners) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia leptophylla (Scheele) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia leptophylla (Scheele) Shinners var. *mexicana* (Shinners) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia mosieri (Small) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia oreithales (Robins.) Shinners, comb. nov. Sida 4: 274. 22 Jul 1971.

Brickellia schaffneri (Gray) Shinners, comb. nov. Sida 4: 22 Jul 1971.

Brunnichia ovata (Walt.) Shinners, comb. nov. Sida 3: 115. 31 May 1967.

Cacalia elliottii (Harper) Shinners, comb. nov. Field & Lab. 18: 80. 3 Apr 1950.

Cacalia lanceolata Nutt. var. *virescens* (Harper) Shinners, comb. nov. Field & Lab. 18: 80. 3 Apr 1950.

Cacalia maxima (Harper) Shinners, comb. nov. Field & Lab. 18: 80. 3 Apr 1950.

Cacalia plantaginea (Raf.) Shinners, comb. nov. Field & Lab. 18: 81-82. 3 Apr 1950.

Cakile lanceolata (Willd.) Schulz var. *geniculata* (Robins.) Shinners, comb. nov. Field & Lab. 20: 33-34. 29 Feb 1952.

Calamintha arkansana (Nutt.) Shinners, comb. nov. Sida 1: 72. 23 Nov 1962.

Calamintha ashei (Weath.) Shinners, comb. nov. Sida 1: 73-74. 23 Nov 1962.

Calamintha georgiana (Harper) Shinners, comb. nov. Sida 1: 74. 23 Nov 1962.

Calylophus hartwegii (Benth.) Raven var. *filifolius* (Eastw.) Shinners, comb. nov. Sida 1: 345. 30 Oct 1964.

Calylophus hartwegii (Benth.) Raven var. *lavandulaefolius* (T. & G.) Shinners, comb. nov. Sida 1: 345. 30 Oct 1964.

Calylophus hartwegii (Benth.) Raven var. *maccartii* Shinners, var. nov.

Type: R. E. Benavides 91 (SMU). Sida 1: 343-344. 30 Oct 1964.

Calylophus hartwegii (Benth.) Raven var. *pubescens* (Gray) Shinners, comb. nov. Sida 1: 344-345. 30 Oct 1964.

Calylophus hartwegii (Benth.) Raven var. *toumeyi* (Small) Shinners, comb. nov. Sida 1: 341. 30 Oct 1964.

Calylophus serrulatus (Nutt.) Raven var. *arizonicus* Shinners, var. nov. Type: S. J. Preece, Jr. & B. L. Turner 2692 (SMU). Sida 1: 338. 30 Oct 1964.

Calylophus serrulatus (Nutt.) Raven var. *spinulosus* (Nutt., ined; ex T. & G.) Shinners, comb. nov. Sida 1: 339-341. 30 Oct 1964.

Calystegia sepium var. *fraterniflora* (Mack. & Bush) Shinners, comb. nov. Sida 3: 282. 21 Jun 1968.

Capsicum annuum L. var. *minus* (Fing.) Shinners, comb. nov. Baileya 4: 82. 29 Jun 1956.

Carex caroliniana Schwein. var. *cuspidata* (Dew.) Shinners, comb. nov. Field & Lab. 22: 30. Jan 1954.

Castilleja purpurea (Nutt.) G. Don var. *citrina* (Penn.) Shinners, comb. nov. Spring Flora of the Dallas-Fort Worth Area, Texas, p. 410. 3 Apr 1958.

Castilleja purpurea (Nutt.) G. Don var. *lindheimeri* (Gray) Shinners, comb. nov. Spring Flora of the Dallas-Fort Worth Area, Texas, p. 410. 3 Apr 1958.

Cayaponia quinqueloba (Raf.) Shinners, comb. nov. Field & Lab. 25: 32. 15 Mar 1957.

Ceanothus herbaceus Raf. var. *pubescens* (T. & G.) Shinners, comb. nov. Field & Lab. 19: 33-34. 18 Jan 1951.

Cenchrus parviceps Shinners, sp. nov. Type: L. H. Shinners 16990 (SMU). Field & Lab. 24: 73-74. 25 Jul 1956.

Centaurium calycosum (Buckl.) Fern. var. *breviflorum* Shinners, var. nov. Type: C. L. & A. A. Lundell 10022 (SMU). Field & Lab. 18: 130. 9 May 1950.

Chaetopappa asteroides (Nutt.) DC. var. *grandis* Shinners, var. nov. Type: C. L. & A. A. Lundell 9982 (SMU). Wrightia 1: 76. 30 Apr 1946.

Chaetopappa bellidifolia (Gray & Engelm.) Shinners, comb. nov. Wrightia 1: 71-73. 30 Apr 1946.

Chaetopappa bellioides (Gray) Shinners, comb. nov. Wrightia 1: 77-79. 30 Apr 1946.

Chaetopappa bellioides (Gray) Shinners var. *hirticaulis* Shinners, var. nov. Type: H. H. Bartlett 10359 (SMU). Wrightia 1: 79. 30 Apr 1946.

Chaetopappa effusa (Gray) Shinners, comb. nov. Wrightia 1: 68-69. 30 Apr 1946.

Chaetopappa keerlioides Shinners, sp. nov. Type: F. L. Wynd & C. H. Mueller 369 (MO; isotypes GH, UC, NY, US). Wrightia 1: 69. 30 Apr 1946.

Chaetopappa pulchella Shinners, sp. nov. Type: I. M. Johnston 7151 (GH). Wrightia 1: 79-80. 30 Apr 1946.

Chamaesyce carunculata (Waterfall) Shinners, comb. nov. Field & Lab. 20: 24. 29 Feb 1952.

Chamaesyce fendleri (T. & G.) Small var. *chaetocalyx* (Boiss.) Shinners, comb. nov. Field & Lab. 17: 70. 30 Mar 1949.

Chamaesyce fendleri (T. & G.) Small var. *triligulata* (Wheeler) Shinners, comb. nov. Field & Lab. 17: 70. 30 Mar 1949.

Chamaesyce golondrina (Wheeler) Shinners, comb. nov. Field & Lab. 17: 70. 30 Mar 1949.

Chamaesyce jejuna (Johnston & Warnock) Shinners, comb. nov. Sida 3: 347. 6 Aug 1969.

Chamaesyce missurica (Raf.) Shinners, comb. nov. Field & Lab. 17: 69-70. 30 Mar 1949.

Chamaesyce missurica (Raf.) Shinners var. *calcicola* Shinners, var. nov. Type: L. H. Shinners 9367 (SMU). Field & Lab. 17: 69-70. 30 Mar 1949.

Chamaesyce perennans Shinners, sp. nov. Type: B. L. Turner 3203, B. B. Tharp & B. H. Warnock 53-539 (SMU). Field & Lab. 24: 38. 15 Jun 1956.

Chamaesyce polycarpa (Benth.) Millsp. var. *simulans* (L. C. Wheeler) Shinners, comb. nov. Field & Lab. 17: 70. 30 Mar 1949.

Chamaesyce theriaca (L. C. Wheeler) Shinners, comb. nov. Field & Lab. 17: 70. 30 Mar 1949.

Chrysopsis wisconsinensis Shinners, sp. nov. Type: H. C. Greene, s. n., 7 Jul 1947 (SMU; isotypes GH, IU, MIL, UWM). Wrightia 1: 218-219. 30 Jun 1948.

Chrysothamus viscidiflorus (Hook.) Nutt. var. *ludens* Shinners, var. nov. Type: L. H. Shinners 9063 (SMU). Sida 1: 374-375. 30 Oct 1964.

Cirsium terrae-nigrae Shinners, sp. nov. Type: L. H. Shinners 7486 (SMU). Field & Lab. 17: 27-29. 18 Feb 1949.

Cirsium texanum Buckl. var. *stenolepis* Shinners, var. nov. Type: L. H. Shinners 11192 (SMU). Field & Lab. 19: 81. 1 Jun 1951.

Collinsonia L. subg. *Micheliella* (Briq.) Shinners, stat. nov. Sida 1: 76-77. 23 Nov 1962.

Conradina brevifolia Shinners, sp. nov. Type: R. Garrett 41 (FLAS). Sida 1: 88. 23 Nov 1962.

Conradina glabra Shinners, sp. nov. Type: F. H. Sargent 6219 (SMU). Sida 1: 85-86. 23 Nov 1962.

Corydalis micrantha Engelm. & Gray var. *australis* (Chapm.) Shinners, comb. nov. Field & Lab. 18: 42. 2 Jan 1950.

Corydalis micrantha Engelm. & Gray var. *texensis* (G. B. Ownbey) Shinners, comb. nov. Field & Lab. 18: 42. 2 Jan 1950.

Croptilon divaricatum var. *graniticum* (E. B. Smith) Shinners, comb. nov. Sida 3: 348. 6 Aug 1969.

Croptilon divaricatum (Nutt.) Raf. var. *hirtellum* (Shinners) Shinners, comb. nov. Field & Lab. 19: 134. 24 Jul 1951.

Croptilon divaricatum (Nutt.) Raf. var. *hookerianum* (T. & G.) Shinners, comb. nov. Field & Lab. 19: 134. 24 Jul 1951.

Croton capitatus Michx. var. *albinoides* (Ferg.) Shinners, comb. nov. Field & Lab. 19: 183. 15 Oct 1951.

Croton glandulosus L. var. *hirsutus* Shinners, var. nov. Type: V. L. Cory 54597 (SMU). Field & Lab. 19: 183. 15 Oct 1951.

Cryptantha jamesii var. *setosa* (M. E. Jones) Shinners, comb. nov. Sida 3: 347. 6 Aug 1969.

Cynanchum arizonicum (Gray) Shinners, comb. nov. Sida 1: 365. 30 Oct 1964.

Cynanchum barbigerum (Scheele) Shinners, comb. nov. Field & Lab. 19: 65. 1 June 1951.

Cynanchum barbigerum (Scheele) Shinners var. *breviflorum* Shinners, var. nov. Type: G. L. Webster 4340 (SMU). Sida 1: 360. 30 Oct 1964.

Cynanchum blodgettii (Gray) Shinners, comb. nov. Sida 1: 365. 30 Oct 1964.

Cynanchum grayi Shinners, nom. nov. Field & Lab. 20: 110. 8 Jul 1952.

Cynanchum maccartii Shinners, nom. nov. Sida 1: 360. 30 Oct 1964.

Cynanchum palmeri (Wats.) Shinners, comb. nov. Field & Lab. 19: 65. 1 Jun 1951.

Cynanchum wigginsii Shinners, nom. nov. Sida 1: 365. 30 Oct 1964.

Cyperus globulosus Aubl. var. *robustus* (Boeck.) Shinners comb. nov. Field & Lab. 20: 34. 29 Feb 1952.

Cyperus virens Michx. var. *arenicola* (Steud.) Shinners, comb. nov. Field & Lab. 22: 30. Jan 1954.

Dalea candida Willd. var. *oligophylla* (Torr.) Shinners, comb. nov. Spring Flora of the Dallas-Fort Worth Area, Texas, p. 409. 3 Apr 1958.

Dalea drummondiana Shinners, nom. nov. Field & Lab. 17: 83. 13 Jul 1949.

Dalea emarginata (T. & G.) Shinners, comb nov. Field & Lab. 17: 84. 13 Jul 1949.

Dalea glandulosa (Coult. & Fish.) Shinners, comb. nov. Field & Lab. 17: 83. 13 Jul 1949.

Dalea grisea (T. & G.) Shinners, comb. nov. Field & Lab. 17: 84. 13 Jul 1949.

Dalea helleri Shinners, nom. nov. Field & Lab. 21: 165. 15 Feb 1954.

Dalea laxiflora Pursh var. *pumila* Shinners, var. nov. Type: E. Whitehouse 10515 (SMU). Field & Lab. 21: 164. 15 Feb 1954.

Dalea multiflora (Nutt.) Shinners, comb. nov. Field & Lab. 17: 82. 13 Jul 1949.

Dalea obovata (T. & G.) Shinners, comb. nov. Field & Lab. 17: 84. 13 Jul 1949.

Dalea oligophylla (Torr.) Shinners, comb. nov. Field & Lab. 17: 82-83. 13 Jul 1949.

Dalea phleoides (T. & G.) Shinners, comb. nov. Field & Lab. 17: 83. 13 Jul 1949.

Dalea purpurea Vent. var. *tenuis* (Coult.) Shinners, comb. nov. Field & Lab. 21: 165. 15 Feb 1954.

Dalea reverchoni (Wats.) Shinners, comb. nov. Field & Lab. 17: 84. 13 Jul 1949.

Dalea sabinalis (Wats.) Shinners, comb. nov. Field & Lab. 17. 83. 13 Jul 1949.

Dalea stanfieldii (Small) Shinners, comb. nov. Field & Lab. 17: 84-85. 13 Jul 1949.

Dalea tenuifolia (Gray) Shinners, comb. nov. Field & Lab. 17: 84. 13 Jul 1949.

Dalea tenuis (Coult.) Shinners, comb. nov. Field & Lab. 17: 84. 13 Jul 1949.

Delphinium virescens Nutt. var. *wootoni* (Rydb.) Shinners, comb. nov. Field & Lab. 17: 89. 13 Jul 1949.

Descurainia pinnata var. *glabra* (Woot. & Standl.) Shinners, comb. nov. Field & Lab. 17: 145. 24 Oct 1949.

Descurainia pinnata var. *ochroleuca* (Woot.) Shinners, comb. nov. Field & Lab. 17: 145. 24 Oct 1949.

Descurainia pinnata var. *osmiarum* (Cockll.) Shinners, comb. nov. Field & Lab. 17: 145. 24 Oct 1949.

Desmodium dichromum Shinners, sp. nov. Type: E. Whitehouse 15866 (SMU). Spring Flora of the Dallas-Fort Worth Area, Texas, pp. 409-410. 3 Apr 1958.

Dianthera americana L. var. *subcoriacea* (Fern.) Shinners, comb. nov. Field & Lab. 25: 79-80. 26 Sep 1957.

Dicerandra frutescens Shinners, sp. nov. Type: F. H. Sargent 6600 (SMU). Sida 1: 89-90. 23 Nov 1962.

Drosera leucantha Shinners, sp. nov. Type: A. Cronquist 5255 (SMU; isotypes NY, US). Sida 1: 57-58. 23 Nov 1962.

Echinochloa crusgalli (L.) Beauv. var. *macera* (Wieg.) Shinners, comb. nov. Rhodora 56: 34. 17 Mar 1954.

Echinochloa crusgalli (L.) Beauv. var. *microstachya* (Wieg.) Shinners, comb. nov. Rhodora 56: 34. 17 Mar 1954.

Echinochloa crusgalli (L.) Beauv. ssp. *muricata* (Michx.) Shinners, comb. nov. Rhodora 56: 33-34. 17 Mar 1954.

Echinochloa crusgalli (L.) Beauv. ssp. *zelayensis* (H. B. K.) Shinners, comb. nov. Rhodora 56: 33-34. 17 Mar 1954.

Egletes commixta Shinners, sp. nov. Type: W. E. Broadway 4149 (GH; isotype US). Lloydia 12: 243. 20 Mar 1950.

Egletes florida Shinners, sp. nov. Type: H. Pittier 6357 (US). Lloydia 12: 248. 20 Mar 1950.

Egletes liebermanii Sch. Bip. var. *yucatana* Shinners, var. nov. Type: C. L. Lundell 1263 (GH; isotypes UC, F, MO, US). Lloydia 12: 246. 20 Mar 1950.

Egletes repens Shinners, sp. nov. Type: Cuatrecasas 3922 (US). Lloydia 12: 249. 20 Mar 1950.

Egletes viscosa f. *bipinnatifida* Shinners, f. nov. Type: A. H. Curtiss W. Ind. Pl. 697 (GH; isotypes F, US). Lloydia 12: 244-245. 20 Mar 1950.

Egletes viscosa var. *dissecta* Shinners, var. nov. Type: J. G. Ortega 5156 (GH; isotype US). Lloydia 12: 245. 20 Mar 1950.

Elymus canadensis L. var. *villosus* (Muhl.) Shinners, comb. nov. Rhodora 56: 28. 17 Mar 1954.

Elymus trachycaulus (Link) Gould ex Shinners, comb. nov. Rhodora 56: 28. 17 Mar 1954.

Encelia scaposa Gray var. *stenophylla* Shinners, var. nov. Type: V. L. Cory 43870 (SMU). Sida 1: 375. 30 Oct 1964.

Eragrostis oxylepis Torr. var. *beyrichii* (J. G. Smith) Shinners, comb. nov. Field & Lab. 20: 34. 29 Feb 1952.

Ericameria laricifolia (Gray) Shinners, comb. nov. Field & Lab. 18: 27. 2 Jan 1950.

Ericameria triantha (Blake) Shinners, comb. nov. Field & Lab. 19: 133. 24 Jul 1951.

Erigeron geiseri Shinners, sp. nov. Type: L. H. Shinners 7205 (SMU). Wrightia 1: 183-184. 15 Dec 1947.

Erigeron geiseri Shinners var. *calcicola* Shinners, var. nov. Type: L. H. Shinners 7329 (SMU). Wrightia 1: 184. 15 Dec 1947.

Erigeron lobatus A. Nels. var. *warnockii* Shinners, var. nov. Type: Warnock 424 (TEX). Sida 1: 376. 30 Oct 1964.

Erigeron mimegletes Shinners, sp. nov. Type: V. L. Cory 53650 (SMU). Wrightia 1: 184-186. 15 Dec 1947.

Erigeron traversii Shinners, sp. nov. Type: Lundell & Lundell 11093 (SMU). Sida 1: 376. 30 Oct 1964.

Eriogonum vespinum Shinners, sp. nov. Type: L. H. Shinners 18967 (SMU). Field & Lab. 22: 68-69. June 1954.

Eustoma barkleyi Standl. ex Shinners, sp. nov. Type: A. Hernandez C., C. M. Rowell, & F. A. Barkley 16M548 (TEX). Southwest. Nat. 2: 39-40. 15 Oct 1957.

Eustoma grandiflorum (Raf.) Shinners, comb. nov. Southwest. Nat. 2: 41-43. 15 Oct 1957.

Eustoma grandiflorum (Raf.) Shinners f. *bicolor* (Standl.) Shinners, comb. nov. Southwest. Nat. 2: 41. 15 Oct 1957.

Eustoma grandiflorum (Raf.) Shinners f. *fisheri* (Standl.) Shinners, comb. nov. Southwest. Nat. 2: 41. 15 Oct 1957.

Eustoma grandiflorum (Raf.) Shinners f. *flaviflorum* (Cockll.) Shinners, comb. nov. Southwest. Nat. 2: 42-43. 15 Oct 1957.

Eustoma grandiflorum (Raf.) Shinners f. *roseum* (Standl.) Shinners, comb. nov. Southwest. Nat. 2: 41-42. 15 Oct 1957.

Filago candida (T. & G.) Shinners, comb. nov. Sida 1: 252-253. 25 Jun 1964.

Filago nuttallii Shinners, nom. nov. Sida 1: 253. 25 Jun 1964.

Filago verna (Raf.) Shinners, comb. nov. Sida 1: 253. 25 Jun 1964.

Filago verna (Raf.) Shinners var. *drummondii* (T. & G.) Shinners, comb. nov. Sida 1: 253. 25 Jun 1964.

Forestiera pubescens Nutt. var. *glabrifolia* Shinners, var. nov. Type: L. H. Shinners 11331 (SMU). Field & Lab. 18: 99-100. 3 Apr 1950.

Gentiana deloachii (W. P. Lemmon) Shinners, comb. nov. Sida 1: 107. 23 Nov 1962.

Gerardia tenuifolia Vahl var. *leucanthera* (Raf.) Shinners, comb. nov. Field & Lab. 18: 130. 9 May 1950.

Gerardia tenuifolia Vahl var. *polyphylla* (Small) Shinners, comb. nov. Field

& Lab. 18: 130. 9 May 1950.

Gilia ludens Shinners, sp. nov. Type: L. H. Shinners 19581 (SMU). Sida 1: 174-175. 12 Dec 1963.

Gilia perennans Shinners, sp. nov. Type: D. S. Correll 13958 (SMU). Sida 1: 174. 12 Dec 1963.

Grindelia lanceolata Nutt. var. *texana* (Scheele) Shinners, comb. nov. Field & Lab. 19: 78. 1 Jun 1951.

Hedyotis angulata Fosb. ex Shinners, nom. nov. Field & Lab. 17: 166-167. 24 Oct 1949.

Hedyotis crassifolia Raf. var. *micrantha* Shinners, var. nov. Type: E. Whitehouse 20848 (SMU). Field & Lab. 18: 100. 3 Apr 1950.

Hedyotis croftiae (Britt. & Rusby) Shinners, comb. nov. Field & Lab. 17: 167. 24 Oct 1949.

Hedyotis greenmanii Fosb. ex Shinners, nom. nov. Field & Lab. 17: 167. 24 Oct 1949.

Hedyotis nigricans (Lam.) Fosb. var. *filifolia* (Chapm.) Shinners, comb. nov. Field & Lab. 17: 168. 24 Oct 1949.

Hedyotis nigricans (Lam.) Fosb. var. *rigidiuscula* (Gray) Shinners, comb. nov. Field & Lab. 17: 168. 24 Oct 1949.

Hedyotis polypremoides (Gray) Shinners, comb. nov. Field & Lab. 17: 168. 24 Oct 1949.

Hedyotis salina (Heller) Shinners, comb. nov. Field & Lab. 17: 169. 24 Oct 1949.

Hedyotis subviscosa (Wright) Shinners, comb. nov. Field & Lab. 17: 169. 24 Oct 1949.

Hedyotis taylorae Fosb. ex Shinners, nom. nov. Field & Lab. 17: 169. 24 Oct 1949.

Heleastrum chapmanii (T. & G.) Shinners, comb. nov. Sida 3: 348. 6 Aug 1969.

Heleastrum hemisphericum (Alex.) Shinners, comb. nov. Field & Lab. 17: 170-171. 24 Oct 1949.

Heleastrum verutifolium (Alex.) Shinners, comb. nov. Field & Lab. 17: 171. 24 Oct 1949.

Helianthus annuus L. var. *texanus* (Heiser) Shinners, comb. nov. Sida 1: 377. 30 Oct 1964.

Helianthus ludens Shinners, sp. nov. Type: Turner, Tharp, & Warnock 53-543 (SMU). Sida 1: 377-378. 30 Oct 1964.

Heteranthera liebmannii (Buch.) Shinners, comb. nov. Field & Lab. 23: 21. 8 Jun 1955.

Heterotheca aspera (Shuttlew.) Shinners, comb. nov. Sida 3: 348. 6 Aug 1969.

Heterotheca breweri (Gray) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca camporum (Greene) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca canescens (DC.) Shinners, comb. nov. Field & Lab. 19: 68.

1 Jun 1951.

Heterotheca echioides (Benth.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca foliosa (Nutt.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca fulcrata (Greene) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca gossypina (Michx.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca graminifolia (Michx.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca microcephala (Small) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca nervosa (Willd.) Shinners, comb. nov. Field & Lab. 19: 68. 1 Jun 1951.

Heterotheca oregona (Nutt.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca pilosa (Nutt.) Shinners, comb. nov. Field & Lab. 19: 68. 1 Jun 1951.

Heterotheca rutteri (Roth.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca sessiliflora (Nutt.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca stenophylla (Gray) Shinners, comb. nov. Field & Lab. 19: 68. 1 Jun 1951.

Heterotheca trichophylla (Nutt.) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca villosa (Pursh) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Heterotheca wisconsinensis (Shinners) Shinners, comb. nov. Field & Lab. 19: 71. 1 Jun 1951.

Hybanthus linearis (Torr.) Shinners, comb. nov. Field & Lab. 19: 126. 24 Jul 1951.

Hymenocallis eulae Shinners, sp. nov. Type: E. Whitehouse 16448 (SMU). Field & Lab. 19: 103. 1 Jun 1951.

Hymenocallis liriosme (Raf.) Shinners, comb. nov. Field & Lab. 19: 102-103. 1 Jun 1951.

Hymenopappus filifolius var. *alpestris* (Maguire) Shinners, comb. nov. Rhodora 61: 155. Jul 1959.

Hymenoxys glabra (Nutt.) Shinners, comb. nov. Field & Lab. 19: 80-81. 1 Jun 1951.

Hymenoxys scaposa (DC.) Parker var. *villosa* Shinners, var. nov. Type: V. L. Cory 53129 (SMU). Field & Lab. 19: 79-80. 1 Jun 1951.

Hyptis alata (Raf.) Shinners, comb. nov. Rhodora 64: 184-186. 27 Jun 1962.

Hyptis alata var. *stenophylla* Shinners, var. nov. Type: R. Kral 5657 (SMU;

isotype FSU). Rhodora 64: 185-186. 27 Jun 1962.

Ipomoea × *multifida* (Raf.) Shinners, comb. nov. Sida 2: 265. 6 Apr 1966.

Ipomoea shumardiana (Torr.) Shinners, comb. nov. Southwest. Nat. 6: 100-101. 1 Sep 1961.

Ipomoea trichocarpa Ell. var. *torreyana* (Gray) Shinners, comb. nov. Field & Lab. 21: 164-165. 15 Feb 1954.

Ipomopsis aggregata (Pursh) V. Grant var. *texana* (Greene) Shinners, comb. nov. Sida 1: 177. 12 Dec 1963.

Ipomopsis wrightii (Gray) Shinners, comb. nov. Sida 1: 178. 12 Dec 1963.

Isocoma megalantha Shinners, sp. nov. Type: J. C. Johnson 1638 (SMU). Field & Lab. 23: 34-36. 13 Jun 1955.

Isocoma palmeri (Gray) Shinners, comb. nov. Field & Lab. 18: 27. 2 Jan 1950.

Isopappus divaricatus (Nutt.) T. & G. var. *hirtellus* Shinners, var. nov. Type: C. L. & A. A. Lundell 10813 (SMU). Field & Lab. 18: 157. 11 Dec 1950.

Isopappus divaricatus (Nutt.) T. & G. var. *hookerianus* (T. & G.) Shinners, comb. nov. Field & Lab. 18: 157. 11 Dec 1950.

Iva angustifolia Nutt. var. *latior* Shinners, var. nov. Type: Lundell & Lundell 11947. Sida 1: 378. 30 Oct 1964.

Koeleria gerardi (Vill.) Shinners, comb. nov. Rhodora 58: 95-96. 4 May 1956.

Koeleria pectinata (Lam.) Shinners, comb. nov. Rhodora 58: 95. 4 May 1956.

Krigia gracilis (DC.) Shinners, comb. nov. Wrightia 1: 205-206. 15 Dec 1947.

Krigia occidentalis Nutt. f. *mutica* (T. & G.) Shinners, comb. nov. Wrightia 1: 200-202. 15 Dec 1947.

Kuhnia eupatorioides L. var. *ozarkana* Shinners, var. nov. Type: E. J. Palmer 33075 (MO; isotype GH). Wrightia 1: 136. 30 Apr 1946.

Kuhnia eupatorioides L. var. *texana* Shinners, var. nov. Type: L. H. Shinners 8475 (SMU). Wrightia 1: 136-138. 30 Apr 1946.

Kuhnia leptophylla Scheele var. *mexicana* Shinners, var. nov. Type: E. Palmer 935 (of the 1896 series) (GH; isotypes UC, MO). Wrightia 1: 128-129. 30 Apr 1946.

Kuhnia microphylla Shinners, sp. nov. Type: Brother Nicolas 5932 (GH; isotype ILL). Wrightia 1: 127. 30 Apr 1946.

Lactuca hirsuta Muhl. var. *albiflora* (T. & G.) Shinners, comb. nov. Field & Lab. 23: 36. 13 Jun 1955.

Liatris aspera Michx. var. *salutans* (Lunell) Shinners, comb. nov. Spring Flora of the Dallas-Fort Worth Area, Texas, p. 410. 3 Apr 1958.

Liatris × *deamii* (Lunell) Shinners, comb. nov., stat. emend. Am. Midl. Nat. 29: 31-32. 6 Mar 1943.

Liatris × *deamii* (Lunell) Shinners f. *albina* Shinners, f. nov. Type: N. C. Fassett 21207 (WIS). Am. Midl. Nat. 29: 31-32. 6 Mar 1943.

Liatris glabrata Rydb. var. *alabamensis* (Alex.) Shinners, comb. nov. Field & Lab. 19: 76. 1 Jun 1951.

Liatris × *gladewitzii* (Farw.) Farw. ex Shinners, comb. nov. Am. Midl. Nat. 29: 37. 6 Mar 1943.

Liatris ligulistylis (A. Nels.) K. Schum. f. *leucantha* Shinners, f. nov. Type: J. Lunell, s. n., 9 Sep 1908 (MIN). Am. Midl. Nat. 29: 39-40. 6 Mar 1943.

Liatris mucronata DC. f. *tharpii* Shinners, f. nov. Type: B. C. Tharp & B. H. Warnock 45-35 (SMU). Field & Lab. 23: 34. 13 Jun 1955.

Liatris novae-angliae (Lunell) Shinners, stat. nov. Am. Midl. Nat. 29: 29. 6 Mar 1943.

Liatris novae-angliae (Lunell) Shinners f. *albiflora* Shinners, f. nov. Type: A. L. Page, s. n., 10 Sep 1909 (GH). Am. Midl. Nat. 29: 29-31. 6 Mar 1943.

Liatris novae-angliae (Lunell) Shinners var. *nieuwlandii* (Lunell) Shinners, comb. nov. Am. Midl. Nat. 29: 31. 6 Mar 1943.

Liatris novae-angliae (Lunell) Shinners var. *nieuwlandii* (Lunell) Shinners f. *alba* Shinners, f. nov. Type: Deam 43670 (IND). Am. Midl. Nat. 29: 31. 6 Mar 1943.

Liatris novae-angliae (Lunell) Shinners var. *nieuwlandii* (Lunell) Shinners f. *trilisioides* (Farw.) Shinners, stat. nov. Am. Midl. Nat. 29: 31. 6 Mar 1943.

Liatris pycnostachya Michx. var. *lasiophylla* Shinners, var. nov. Type: V. L. Cory 54953 (SMU). Field & Lab. 19: 74-75. 1 Jun 1951.

Liatris sphaeroidea Michx. f. *asperifolia* Shinners, f. nov. Type: N. C. Fassett 13469 (WIS). Am. Midl. Nat. 29: 36-37. 6 Mar 1943.

Liatris sphaeroidea Michx. f. *benkei* (Macbr.) Shinners, comb. nov. Am. Midl. Nat. 29: 35-37. 6 Mar 1943.

Liatris sphaeroidea Michx. var. *salutans* (Lunell) Shinners, comb. nov. Am. Midl. Nat. 29: 37. 6 Mar 1943.

Liatris tenuis Shinners, sp. nov. Type: L. H. Shinners 26600 (SMU). Southwest. Nat. 4: 207-208. 1 Dec 1959.

Liatris × *weaveri* Shinners, sp. nov. Type: "From seeds sent by Dr. Weaver to Dr. Gaiser, no. 16" (MO). Am. Midl. Nat. 29: 38. 6 Mar 1943.

Limonium carolinianum (Walt.) Britt. var. *compactum* Shinners, var. nov. Type: V. L. Cory 51236 (SMU). Field & Lab. 24: 105-106. 7 Oct 1956.

Linum imbricatum (Raf.) Shinners, comb. nov. Field & Lab. 25: 32. 15 Mar 1957.

Linum rigidum Pursh var. *filifolium* Shinners ex McVaugh, var. nov. Type: R. McVaugh 7798 (SMU). Field & Lab. 17: 136-137. 24 Oct 1949.

Ludwigia octovalvis (Jacq.) Raven var. *macropoda* (Presl) Shinners, comb. nov. Sida 1: 385. 30 Oct 1964.

Ludwigia octovalvis (Jacq.) Raven var. *sessiliflora* (Mich.) Shinners, comb. nov. Sida 1: 385. 30 Oct 1964.

Ludwigia peploides (H. B. K.) Raven var. *glabrescens* (Kuntze) Shinners, comb. nov. Sida 1: 386. 30 Oct 1964.

Ludwigia peploides (H. B. K.) Raven var. *montevidensis* (Spreng.) Shinners, comb. nov. Sida 1: 386. 30 Oct 1964.

Lupinus perennis L. var. *austrinus* Shinners, var. nov. Type: Curtis School 21 (TEX). Field & Lab. 21: 152-153. 15 Feb 1954.

Lygodesmia bigelovii (Gray) Shinners, comb. nov. Field & Lab. 18: 31. 2 Jan 1950.

Lygodesmia pauciflora (Torr.) Shinners, comb. nov. Field & Lab. 18: 30. 2 Jan 1950.

Lygodesmia tenuifolia (Torr.) Shinners, comb. nov. Field & Lab. 18: 31. 2 Jan 1950.

Lygodesmia thurberi (Gray) Shinners, comb. nov. Field & Lab. 18: 32. 2 Jan 1950.

Lygodesmia wrightii (Gray) Shinners, comb. nov. Field & Lab. 18: 31. 2 Jan 1950.

Machaeranthera annua (Rydb.) Shinners, comb. nov. Sida 1: 378. 30 Oct 1964.

Machaeranthera arenaria (Benth.) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera aurea (Gray) Shinners, comb. nov. Field & Lab. 18: 41. 2 Jan 1950.

Machaeranthera australis (Greene) Shinners, comb. nov. Field & Lab. 18: 42. 2 Jan 1950.

Machaeranthera blephariphylla (Gray) Shinners, comb. nov. Field & Lab. 18: 38-40. 2 Jan 1950.

Machaeranthera correllii Shinners, sp. nov. Type: L. H. Shinners 9059 (SMU). Field & Lab. 17: 56-57. 30 Mar 1949.

Machaeranthera gracilis (Nutt.) Shinners, comb. nov. Field & Lab. 18: 41. 2 Jan 1950.

Machaeranthera grindelioides (Nutt.) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera gymnocephala (DC.) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera havardii (Waterfall) Shinners, comb. nov. Field & Lab. 18: 40-41. 2 Jan 1950.

Machaeranthera juncea (Greene) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera laevis (Woot. & Standl.) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera phyllocephala (DC.) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera phyllocephala (DC.) Shinners var. *annua* (Rydb.) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera phyllocephala (DC.) Shinners var. *megacephala* (Nash) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera pinnata (Nutt.) Shinners, comb. nov. Field & Lab. 18: 41-42. 2 Jan 1950.

Machaeranthera pinnatifida (Hook.) Shinners, comb. nov. Sida 1: 295. 25 Jun 1964.

Machaeranthera scabrella (Greene) Shinners, comb. nov. Field & Lab. 18: 42. 2 Jan 1950.

Machaeranthera stenoloba (Greene) Shinners, comb. nov. Field & Lab. 18: 40. 2 Jan 1950.

Machaeranthera texensis (R. C. Jackson) Shinners, comb. nov. Sida 1: 378. 30 Oct 1964.

Matelea albomarginata (Pittier) Shinners, comb. nov. Sida 1: 365. 30 Oct 1964.

Matelea aristolochiaefolia (Brandeg.) Shinners, comb. nov. Sida 1: 365. 30 Oct 1964.

Matelea arizonica (Gray) Shinners, comb. nov. Sida 1: 366. 30 Oct 1964.

Matelea calycosa (J. D. Smith) Shinners, comb. nov. Sida 1: 366. 30 Oct 1964.

Matelea chiapensis (Brandeg.) Shinners, comb. nov. Sida 1: 366. 30 Oct 1964.

Matelea cteniophora (Blake) Shinners, comb. nov. Sida 1: 366. 30 Oct 1964.

Matelea gonocarpa (Walt.) Shinners, comb. nov. Field & Lab. 18: 73. 3 Apr 1950.

Matelea greenmanii Shinners, nom. nov. Sida 1: 366. 30 Oct 1964.

Matelea johnstonii Shinners, nom. nov. Sida 1: 366. 30 Oct 1964.

Matelea lasiostemma (Hemsl.) Shinners, comb. nov. Sida 1: 366. 30 Oct 1964.

Matelea oblongifolia (J. D. Smith) Shinners, comb. nov. Sida 1: 366. 30 Oct 1964.

Matelea sagittifolia (Gray) Woods. ex Shinners, comb. nov. Sida 1: 363-364. 30 Oct 1964.

Matelea smithii Shinners, nom. nov. Sida 1: 366. 30 Oct 1964.

Matelea stenantha (Standl.) Shinners, comb. nov. Sida 1: 366. 30 Oct 1964.

Matelea woodsonii Shinners, sp. nov. Type: Lundell & Lundell 9926 (SMU). Sida 1: 364. 30 Oct 1964.

Medicago polymorpha L. var. *ciliaris* (Ser.) Shinners, comb. nov. Rhodora 58: 9-12. 24 Jan 1956.

Medicago polymorpha L. var. *ciliaris* (Ser.) Shinners f. *apiculata* (Willd., emend. Urban) Shinners, comb. nov. Rhodora 58: 11. 24 Jan 1956.

Medicago polymorpha L. var. *ciliaris* (Ser.) Shinners f. *tuberculata* (Gren. & Godr.) Shinners, comb. nov. Rhodora 58: 11-12. 24 Jan 1956.

Medicago polymorpha L. var. *polygyra* (Urban) Shinners, comb. nov. Rhodora 58: 9. 24 Jan 1956.

Medicago polymorpha L. var. *tricycla* (Gren. & Godr.) Shinners, comb. nov. Rhodora 58: 8. 24 Jan 1956.

Medicago polymorpha L. var. *vulgaris* (Benth.) Shinners, comb. nov. Rhodora 58: 310. 31 Oct 1956.

Medicago polymorpha L. var. *vulgaris* (Benth.) Shinners f. *apiculata* (Willd.) Shinners, comb. nov. Rhodora 58: 310. 31 Oct 1956.

Medicago polymorpha L. var. *vulgaris* (Benth.) Shinners f. *tuberculata* (Godr.) Shinners, comb. nov. Rhodora 58: 310. 31 Oct 1956.

Micranthemum glomeratum (Chapm.) Shinners, comb. nov. Sida 1: 252. 25 Jun 1964.

Micromeria bahamensis Shinners, sp. nov. Type: N. L. Britton & C. F. Millspaugh 2302 (GH; isotype NY). Sida 1: 96. 23 Nov 1962.

Micromeria brownei (Sw.) Benth. var. *ludens* Shinners, var. nov. Bro. Alain 6137 (NY). Sida 1: 96. 23 Nov 1962.

Micromeria domingensis Shinners, sp. nov. Type: E. L. Ekman, s. n., 8 Sep 1929 (GH). Sida 1: 96. 23 Nov 1962.

Mirabilis collina Shinners, sp. nov. Type: L. H. Shinners 10109 (SMU). Field & Lab. 19: 180. 15 Oct 1951.

Mirabilis dumetorum Shinners, sp. nov. Type: L. H. Shinners 9536 (SMU). Field & Lab. 19: 179. 15 Oct 1951.

Mirabilis cutricha Shinners, sp. nov. Type: L. H. Shinners 11345 (SMU). Field & Lab. 19: 177. 15 Oct 1951.

Mirabilis gigantea (Standl.) Shinners, comb. nov. Field & Lab. 19: 177-178. 15 Oct 1951.

Mirabilis lindheimeri (Standl.) Shinners, comb. nov. Field & Lab. 19: 175-176. 15 Oct 1951.

Mirabilis serotina Shinners, sp. nov. Type: S. P. Gordon 74(SMU). Field & Lab. 19: 179. 15 Oct 1951.

Monarda punctata L. var. *arkansana* (McCl. & Epl.) Shinners, comb. nov. Field & Lab. 21: 90. 12 Jun 1953.

Monarda punctata L. var. *coryi* (McCl. & Epl.) Cory ex Shinners, comb. nov. Field & Lab. 21: 90. 12 Jun 1953.

Monarda punctata L. var. *villicaulis* (Penn.) Shinners, comb. nov. Field & Lab. 21: 90. 12 Jun 1953.

Oxalis dillenii Jacq. var. *radicans* Shinners, var. nov. Type: L. H. Shinners 23872 (SMU). Field & Lab. 24: 39-40. 15 Jun 1956.

Palafoxia callosa (Nutt.) T. & G. var. *bella* (Cory) Shinners, comb. nov. Field & Lab. 20: 94. 8 Jul 1952.

Palafoxia cyanophylla Shinners, sp. nov. Type: L. H. Shinners 8792 (SMU). Field & Lab. 17: 25-27. 18 Feb 1949.

Palafoxia hookeriana T. & G. var. *minor* Shinners, var. nov. Type: G. L. Fisher 50717 (SMU). Field & Lab. 20: 98. 8 Jul 1952.

Palafoxia liebmannii (Sch. Bip.) Shinners, comb. nov. Field & Lab. 17: 25. 18 Feb 1949.

Palafoxia pedata (Cav.) Shinners, comb. nov. Field & Lab. 17: 25. 18 Feb 1949.

Palafoxia rosea (Bush) Cory var. *ambigua* Shinners, var. nov. Type: V. L. Cory 51241 (SMU). Field & Lab. 20: 95. 8 Jul 1952.

Palafoxia rosea (Bush) Cory var. *papposa* Shinners, var. nov. Type: H. B. Parks, s. n., 27 Aug 1934 (TAES; fragments, SMU). Field & Lab. 20: 95. 8 Jul 1952.

Palafoxia texana DC. var. *macrolepis* (Rydb.) Shinners, comb. nov. Field & Lab. 20: 97. 8 Jul 1952.

Palafoxia tripteris (DC.) Shinners, comb. nov. Field & Lab. 17: 24-25. 18 Feb 1949.

Palafoxia tripteris (DC.) Shinners var. *brevis* Shinners, var. nov. Type: V. L. Cory 40710 (SMU). Field & Lab. 20: 94. 8 Jul 1952.

Panicum euchlamydeum Shinners, sp. nov. Type: L. H. Shinners & C. G. Shaw 4415 (WIS; isotypes GH, US, MIN, MIL). Am. Midl. Nat. 32: 170-171.

27 Oct 1944.

Pappopecus Shinners, sect. nov. Wrightia 1: 108. 30 Apr 1946.

Pappophanus (Blake) Shinners, sect. nov. Wrightia 1: 101. 30 Apr 1946.

Parietaria pennsylvanica Muhl. var. *obtusa* (Rydb.) Shinners, comb. nov. Field & Lab. 18: 42. 2 Jan 1950.

Paronychia erecta (Chapm.) Shinners, comb. nov. Sida 1: 102. 23 Nov 1962.

Paronychia patula Shinners, nom. nov. Sida 1: 102. 23 Nov 1962.

Paspalum distichum L. var. *indutum* Shinners, var. nov. Type: L. H. Shinners 10564 (SMU). Rhodora 56: 31. 17 Mar 1954.

Paspalum separatum Shinners, sp. nov. Type: L. H. Shinners 15566 (SMU). Rhodora 56: 32. 17 Mar 1954.

Perityle angustifolia (Gray) Shinners, comb. nov. Southwest. Nat. 4: 204. 1 Dec 1959.

Perityle bisetosa (Torrey) Shinners, comb. nov. Southwest. Nat. 4: 204. 1 Dec 1959.

Perityle cernua (Greene) Shinners, comb. nov. Southwest. Nat. 4: 204. 1 Dec 1959.

Perityle congesta (M. E. Jones) Shinners, comb. nov. Southwest Nat. 4: 204. 1 Dec 1959.

Perityle fastigiata (Brandeg.) Shinners, comb. nov. Southwest. Nat. 4: 204. 1 Dec 1959.

Perityle halimifolia (Gray) Shinners, comb. nov. Southwest. Nat. 4: 204. 1 Dec 1959.

Perityle intricata (Brandeg.) Shinners, comb. nov. Southwest. Nat. 4: 204. 1 Dec 1959.

Perityle lindheimeri (Gray) Shinners, comb. nov. Southwest. Nat. 4: 204. 1 Dec. 1959.

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Perityle rotundata (Rydb.) Shinners, comb. nov. Southwest. Nat. 4: 205. 1 Dec 1959.

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Perityle staurophylla (Barneby) Shinners, comb. nov. Southwest. Nat. 4: 205. 1 Dec 1959.

Perityle villosa (Blake) Shinners, comb. nov. Southwest. Nat. 4: 205. 1 Dec 1959.

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Phlox drummondii Hook. var. *mcallisteri* (Whiteh.) Shinners, comb. nov. Field & Lab. 19: 127. 24 Jul 1951.

Phlox drummondii Hook. var. *peregrina* Shinners, var. nov. Type: V. E. Bono 6 (SMU). Field & Lab. 19: 127. 24 Jul 1951.

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Physostegia serotina Shinners, sp. nov. Type: L. H. Shinners 22108 (SMU). Field & Lab. 24: 17. 15 Jun 1956.

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Rudbeckia coryi Shinners, sp. nov. Type: V. L. Cory 52412 (SMU). Field & Lab. 17: 59-62. 30 Mar 1949.

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Solidago rigida L. var. *laevicaulis* Shinners, var. nov. Type: E. Whitehouse 19269. Field & Lab. 19: 35. 18 Jan 1951.

Spergula platensis (St. Hil. & A. Juss.) Shinners, comb. nov. Spring Flora of the Dallas-Fort Worth Area, Texas, p. 409. 3 Apr 1958.

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Thelesperma fraternum Shinners, sp. nov. Type: L. H. Shinners 7418 (SMU). Field & Lab. 18: 21-23. 2 Jan 1950.

Thelesperma intermedium Rydb. var. *rubrodiscum* Shinners, var. nov. Type: Shinners 7438 (SMU). Field & Lab. 18: 19-20. 2 Jan 1950.

Thelesperma megapotamicum (Spreng.) Kuntze var. *ambiguum* (Gray) Shinners, comb. nov. Field & Lab. 18: 23. 2 Jan 1950.

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Tragia nepetaefolia Cav. var. *leptophylla* (Torr.) Shinners, comb. nov. Southwest. Nat. 6: 101. 1 Sep 1961.

Tragia smallii Shinners, sp. nov. Type: R. McVaugh 8461 (SMU). Field & Lab. 24: 37. 15 Jun 1956.

Tragia urticifolia Michx. var. *texana* Shinners, var. nov. Type: L. H. Shinners 11133 (SMU). Field & Lab. 19: 183. 15 Oct 1951.

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Viburnum cassinoides var. *angustifolium* (T. & G.) Shinners, comb. nov. Southwest. Nat. 1: 91. 22 Jan 1957.

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Digitaria 1957a, 1964o
Diplacus 1959e
Diplopappus 1941d, 1946b, 1964i
Diplostelma 1946a
Distasis 1946a
Ditaxis 1956m
Doellingeria 1941d, 1953k
Doxantha 1961d
Dracocephalum 1949h
Drosera 1962l
Dupratzia 1957o

Echinacea 1949c, 1964n
Echinocereus 1954f
Echinochloa 1954f
Edisonia 1964m
Egletes 1946c, 1946d, 1947a, 1949r, 1949s
Eichhornia 1962u
Elaeagnus 1955g
Elephantopus 1951g
Elodea 1956q
Elodes 1956q
Elymus 1954f
Emilia 1950g
Enallagma 1961d
Encelia 1964n
Enslenia 1950f, 1964m
Enstoma 1957o
Ephedra 1954f
Epicion 1964m
Epilobium 1941b
Eragrostis 1940b, 1952d, 1954f, 1973
Eremiastrum 1946a, 1951f
Eriastrum 1963b
Ericameria 1950b, 1951o
Erigeron 1946a, 1946c, 1946d, 1947a, 1949n, 1949q, 1949r, 1951f, 1951o, 1953k, 1962v, 1964n
Eriochloa 1956c
Eriogonum 1954i, 1955g, 1956v
Eriophyllum 1949r
Erythraea 1957o
Eschenbachia 1949n
Eucephalus 1946b
Eupatorium 1946c, 1964n
Euphorbia 1949e, 1949q, 1952a, 1956l, 1962t, 1969c
Eustoma 1957o
Eustylis 1964h
Euthamia 1946a, 1950b, 1951p, 1956k
Evax 1951k, 1964d, 1964n
Evolvulus 1962d
Exolobus 1964m
Eyselia 1949r
Eysenhardtia 1949i

Facelis 1949q
Fagara 1956g, 1957f
Festuca 1940b, 1956b
Filaginopsis 1951k, 1964d
Filago 1951k, 1953g, 1964d, 1964n
Fimbristemma 1964m
Fischeria 1964m
Florestina 1949b, 1952c
Forcipella 1962w
Forestiera 1950j, 1956aa, 1959b
Franseria 1949q
Froelichia 1954i
Funastrum 1950f, 1964m

Gaertneria 1949q
Gaillardia 1956v
Galinsoga 1953k
Galpinsia 1964l
Garuleum 1949s
Geboscon 1957b
Gentiana 1949p, 1957o, 1962bb
Geoprumnon 1956e
Gerardia 1950n, 1962e

Gibbesia 1962w
Gilia 1963b, 1963c
Glandularia 1966a
Glycyrrhiza 1955g
Gnaphalium 1941d, 1966f
Gomphocarpa 1964m
Gonolobus 1950f, 1964m
Grangea 1949r, 1949s
Greenella 1949r, 1950b
Grindelia 1951g, 1953g, 1956v
Guara 1955g
Gutierrezia 1946a, 1950b, 1951f, 1951p
Gymnosperma 1950b
Gymnostyles 1953k

Halictus 1957i
Haplopappus 1949q, 1950b, 1950c, 1950q, 1951f, 1951o, 1956v, 1964n, 1969g
Hedeoma 1962n
Hedyotis 1949p, 1950k, 1953n, 1954i, 1961f, 1963b
Hedypnois 1949a, 1950q
Heleastrum 1949q, 1969h
Helenium 1961f
Heleochloa 1940b
Helianthus 1950b, 1957i, 1964n
Heliopsis 1951g
Helleborus 1956ff
Hemiachyris 1950b
Hemianthus 1964c
Hemiptilium 1950b
Hemisia 1956cc, 1957j
Herniaria 1962w
Heteranthera 1955d
Heterocallis 1956ff
Heterosperma 1950a
Heterotheca 1951f, 1956v, 1963a, 1969f
Hibiscus 1956ff
Himantostemma 1964m
Hoffmannseggia 1946e
Holcus 1956z
Holosteum 1965c
Hordeum 1962t
Houstonia 1949p, 1950k
Hybanthus 1951l
Hymenocallis 1951i
Hymenopappus 1949q, 1959a
Hymenoxis 1951g
Hyoseris 1947b
Hypericum 1956q
Hypochoeris 1956bb, 1966f
Hypogon 1962o
Hyptis 1962c
Hyssopus 1955g

Ilex 1962t
Inula 1946b, 1950q, 1951f, 1969f
Ionactis 1941d, 1946b
Ionidium 1951l
Ipomoea 1953n, 1961b, 1962b, 1965a, 1965b, 1965c, 1965d, 1965g
Ipomopsis 1963b
Iresine 1962a
Ismene 1951i
Isocoma 1950b, 1951p, 1955e
Isopappus 1946c, 1950b, 1950q, 1951o
Iva 1964n

Jacaranda 1961d
Jaumea 1946e
Juncus 1954f
Jussiaea 1964r
Justicia 1957l

Keerlia 1946a, 1946d, 1949q, 1949r
Keithia 1962p
Kleinia 1950g
Knifa 1956q
Koeleria 1956b
Krigia 1946a, 1947b, 1949q, 1956e, 1959c, 1962t
Krynitzkia 1969e
Kuhnia 1946e, 1949q, 1953f, 1956e, 1964k, 1964n, 1968b, 1971b
Kuhnistera 1949i, 1953o

Lachnostoma 1964m

Lacinaria 1943a, 1951g
Lactuca 1949q, 1955e, 1955g
Laphamia 1949q, 1959c
Lasioglossum 1956cc, 1957i, 1957j
Lathyrus 1948a
Laxanon 1947b
Leontodon 1947b, 1949a
Lepachys 1949j
Leptochloa 1940b, 1941c, 1954f
Leptoglossis 1963c
Leptoloma 1941c, 1944b
Lespedeza 1941c, 1948c, 1956e
Lessingia 1949c
Leucelene 1946a, 1946b, 1946c, 1946d, 1949q, 1951o
Leucopsidium 1946d
Liatris 1943a, 1946e, 1950c, 1951g, 1955e, 1959d
Lilium 1955g, 1956v
Limnosciadium 1962t
Limonium 1956t
Lianthus 1963b, 1963c
Linum 1957c
Liquidambar 1962g
Liquiritia 1955g
Lisianthus 1957o
Littorella 1967c
Loeselia 1963b
Lolium 1969b
Lophochloa 1956b
Ludwigia 1964r
Lupinus 1953i
Luthera 1947b
Lygodesmia 1949p, 1950b, 1953n, 1954i
Lyonia 1964m
Lysianthus 1957o
Lythrum 1953a, 1956e, 1957i

Macbridea 1962n
Machaeranthera 1946c, 1949c, 1949q, 1950c, 1964i, 1964n
Madia 1955e
Malva 1955g, 1956v
Malvastrum 1953f
Mamillaria 1955g, 1956v
Manfreda 1966b, 1967e
Marshallia 1949q
Matelea 1950f, 1964m
Matricaria 1949r
Mazus 1962g
Medicago 1948c, 1956a, 1956w
Megachile 1957i, 1957j
Melinia 1964m
Melissa 1962n
Melissodes 1956cc, 1957i, 1957j
Mellichampia 1964m
Melochia 1962t
Melosmon 1971c
Menispermum 1954f
Meriolix 1964l
Mesadenia 1950g
Metalepis 1964m
Metastelma 1950f, 1951c, 1952f, 1964m
Micheliella 1962o
Micranthemum 1964c
Micromeria 1962n, 1962s
Microseris 1955e, 1964n
Mikania 1950g
Mimulus 1955c, 1959e
Minuartia 1962k
Mirabilis 1951c, 1951t, 1954f, 1961f, 1963b
Monarda 1953b, 1962c
Monoptilon 1946a, 1951f
Monothrix 1959c
Muhlenbergia 1940b, 1941c
Myriactis 1949s

Nabulus 1953k
Narcissus 1951i
Nemostylis 1964h
Nezera 1957c
Nierembergia 1963c
Nomada 1957i
Nothocalais 1964n
Nothoscordum 1957b

Odontonychia 1962w

Odontostephana 1950f, 1964m
Oenothera 1953a, 1955g, 1956v, 1964l
Oldenlandia 1949p
Olearia 1950c
Ophryosporus 1946e
Oplismenus 1954f
Orbexilum 1951a
Oryzopsis 1940b
Osmia 1957i
Othake 1949b, 1952e
Oxalis 1956o, 1957n
Oxybaphus 1951t
Oxypetalum 1964m
Oxypterix 1964m

Palafoxia 1949b, 1952e
Pancratium 1951i
Panicum 1940b, 1944b, 1954f
Papaver 1956ff
Pappothrix 1959c
Parietaria 1950d
Paronychia 1962w
Parthenium 1949q
Paspalum 1954f, 1962t
Pattalias 1952f, 1964m
Paulownia 1961d
Pediomelum 1951a
Peganum 1948c
Pegolettia 1946e
Penstemon 1955g, 1956v
Pepsis 1956cc
Perdita 1957i
Perilla 1957a
Periploca 1964m
Perityle 1959c
Perizoma 1962h
Persicaria 1957n, 1967b
Petalostemum 1946e, 1949i, 1949j, 1953o
Petrorhagia 1969b
Phalangium 1955g, 1956v
Phalaris 1956b
Pharbitis 1962b, 1965a, 1965d
Pherosphaera 1957f
Pherotrichis 1964m
Philibertella 1950f, 1964m
Philibertia 1950f, 1964m
Phlox 1951m, 1953n, 1956e, 1961a, 1963b, 1963c
Phyla 1957i
Physalis 1951s, 1962h
Physostegia 1949h, 1951q, 1953j, 1956f
Piloblephis 1962n, 1962r
Pinaropappus 1951d
Pinus 1956c
Pityopsis 1951f
Plantago 1950g, 1950l, 1967c
Platystephium 1949r, 1949s
Pleuradenia 1962o
Pleuropterus 1967b
Pluchea 1946c, 1967d
Poa 1943c, 1954f, 1956b, 1962t
Podostigma 1964m
Polemonium 1963b
Polianthes 1966b, 1967e
Polistes 1957i
Polyactidium 1946c
Polyanthes see *Polianthes*
Polygonum 1957n, 1967b
Polypappus 1967d
Polypteris 1949b, 1952e
Porophyllum 1950g
Potamogeton 1955d
Potentilla 1955c
Prenanthes 1950b, 1953k, 1964s
Prionopsis 1949q, 1957i, 1964n
Prochnyanthes 1966b
Prunus 1956x
Pseudobravoa 1966b
Pseudotsuga 1956c
Psilactis 1949c, 1964n
Psoralea 1946e, 1949i, 1951a, 1955g
Psoralidium 1951a
Ptiloria 1950b
Puccinellia 1940b
Pycnanthemum 1962c
Pycnothymus 1962n
Pyrethrum 1949r

Pyrrhopappus 1951g, 1953e, 1953n, 1956bb, 1957i
Pyrrocoma 1949q

Quamoclit 1965a, 1965g
Quamoclita 1965g
Quercus 1956e, 1956i, 1962t

Rajania 1967a
Ranunculus 1950h, 1960a, 1962t, 1962y
Ratibida 1949j, 1955g, 1956v
Rayania 1967a
Reverchonia 1952a
Reynoutria 1967b
Rhinanthus 1962e
Rhododendron 1961e, 1962f
Rhus 1951h
Ridan 1964e
Rivea 1965a
Rosa 1955i
Rosmarinus 1962p
Rothrockia 1964m
Roulinia 1950f, 1964m
Rouliniella 1950f, 1964m
Rubus 1952e, 1954b
Rudbeckia 1949c, 1949j, 1949q, 1950b, 1955g, 1956v
Ruellia 1953p
Runyonia 1966b
Rygchium 1957i

Salpichroa 1962h
Salvia 1953c, 1956e
Sarcostemma 1964m
Satureja 1962n, 1962s
Schizonotus 1964m
Schkuhria 1949b, 1951o, 1964n
Schmaltzia 1951h
Scilla 1956v
Scorzonera 1947b
Scutellaria 1962dd, 1963a, 1964b
Seddera 1962d
Selloa 1950b
Senecio 1962t, 1964n
Serinia 1946a, 1947b, 1949q
Serophyton 1956m
Serratula 1943a
Seseli 1955g
Seuteria 1964m
Sibara 1962t
Sida 1953f, 1973
Sideranthus 1946c, 1950c, 1955g, 1956v, 1964n
Sieglingia 1954f
Silphium 1941c, 1949j, 1951o, 1954f
Silybum 1958d
Sinapis 1950o
Siphonychia 1962w
Sisyrinchium 1948c, 1951p, 1951s, 1957g, 1962j, 1962t, 1966f
Smilax 1962t
Solandra 1961d
Solanum 1962ee
Solidago 1941c, 1941d, 1946a, 1946d, 1949q, 1950b, 1950c, 1951c, 1951o, 1951p, 1953h, 1953k, 1956k, 1964n
Soliva 1953k
Sophia 1949o
Sophora 1955g, 1956v
Sorghastrum 1954f
Sorghum 1956z, 1962t
Soxmaniorum 1953n
Sphaeralcea 1955g, 1956v, 1964q
Sporobolus 1940b, 1941c, 1941d, 1954f, 1961f
Stachys 1962g, 1963a
Stanleya 1962z
Starkea 1950c, 1964i
Stellaria 1949k, 1962k, 1962x
Stenolobium 1961d
Stenotaphrum 1962t
Stephanomeria 1948c, 1950b
Stevia 1949b
Stiburus 1956b
Stylisma 1962d, 1969d
Swartzia 1961d
Symphyopappus 1946e
Synosma 1950g

Tabebuia 1961d
Tamarix 1948c, 1957h
Taraxacum 1949a
Tecoma 1961d
Tephrosia 1962m
Tessaria 1967d
Tetraneuris 1951g
Teucrium 1963d, 1971c
Thalictrum 1961f
Thelesperma 1950a, 1950i, 1964n, 1966d
Thuraria 1955g, 1956v
Thurovia 1964g
Thymbra 1962n
Thymus 1962n, 1962s
Tigridia 1964h
Tiniaria 1967b
Tomanthera 1962e
Townsendia 1950q
Tradescantia 1962v
Tragia 1951v, 1956j, 1961c
Tragopogon 1947b, 1948c, 1949a
Trichogonia 1946e
Tridens 1954f
Trifolium 1954e, 1962y
Triodia 1954f
Tripolium 1953k
Trisetum 1940b
Triticum 1954f
Troximon 1947b, 1955g, 1964n
Tunica 1969b
Turbina 1965a

Unamia 1941d
Ungnadia 1954f
Uralepis 1954f
Urananthus 1957o

Valerianella 1953d
Vaseyochloa 1964g
Verbena 1966a, 1966f
Verbesina 1950b, 1964e, 1964n
Vernonia 1950b, 1954f
Viburnum 1956dd
Vicia 1948a, 1948c
Viguiera 1964n
Vilfa 1954f
Vincetoxicum 1950f, 1964m
Viola 1956y, 1961f
Virgilia 1955g, 1956v
Vitis 1951u, 1955g, 1956v

Wahlenbergia 1957a
Warea 1962z
Wedelia 1951t
Wedeliella 1951t
Wissadula 1962aa

Xanthisma 1950q
Xanthium 1955e
Xanthocephalum 1946d, 1949r, 1950b, 1951g, 1951p
Xanthoxylem see *Zanthoxylem*
Xerobius 1949r
Ximenesia 1950b
Xylocopa 1956cc, 1957i

Youngia 1962g, 1964s
Yucca 1951r, 1955g, 1956h, 1956v

Zanthoxylem 1956g, 1957f
Zosterella 1955d

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BY ANY OTHER NAME . . .

Lloyd Shinners enjoyed classical music, mystery books, and poetry. He exchanged poetry with many of his friends and in one instance his poetic endeavors became intermingled with his journalistic pursuits.

For his new journal, he selected a simple one-word title for (1) simplicity in reference citations, and (2), one that would be familiar to botanists all over the world. The generic name of SIDA (Malvaceae) was chosen as it fit these criteria.

Upon receiving the first two numbers of the new journal, Professor Ewan penned some lines and a "retaliation" was immediately written. Reproduced copies of Shinners' "retaliation" were inserted (loose-leaf) in the next issue of the journal. With Professor Ewan's permission, the original is reproduced along with Lloyd Shinners' response (Fig. 1).

Librarians, aware of the "retaliation" with the two lines referring to the abbreviation of SIDA, yet unaware of the generic name, have cataloged the journal in one library as an abbreviation. In another library, however, the journal is cataloged as a one-word title. Inquiries are still received from librarians seeking to determine the correct disposition. WFM

Fig. 1. Holograph and typed response of Joseph Ewan and Lloyd Shinners respectively.

SIDA 5(3): 180-181. 1973.

TULANE UNIVERSITY
Department of Botany

Date 24 November 1962

To LHS

From JE

Subject: Sat Down Be Sida

Remarks: Little Lloyd Shinners
Came home in his flivver
To eat his schizocarpic pie
He stuck in his scalpel
And pulled out a carpel
And said what a good taxon
am I!

Now jolly Lloyd Shinners
Replete with new taxa
Locked up his type bed
With plantae nondescripta complexa
Azolla to Zed
Pronounced it well said!
Sida! Oh ~~Sida for aye!~~

TP120-47

HERBARIUM
SOUTHERN METHODIST UNIVERSITY
DALLAS 22, TEXAS

LINES PENNED IN RETALIATION FOR J. EWAN'S
DUBIOUS VERSES PENNED ON THE OCCASION
OF HIS SUBSCRIBING TO S I D A

Listen, my children, and you shall hear
Of saucy SIDA's early career!
On November 23, 1962,
Two issues were mailed - no less would do
To hold its omnium-gatherum chatter
On botany and culture - unprintable matter!
From Siberia to Bolivia plants now bear
New names most recklessly published there,
While botanists smile, or mostly berate
From Harvard clear to the Golden Gate
The effort to make of simple history
Something worse than a murder mystery.
The name is ancient, but Greek though it be,
Please don't say that "It's Greek to me" —
You've two meanings to choose between, you see:

Shinners' Infamous Damnable Activities
Shinners' Interesting Delightful Activities

Is worse to come? Just wait and see!

26 Nov. 1962

CHLORIS TRUNCATA R. BR. (GRAMINEAE), AN AUSTRALIAN WOOL-WASTE ADVENTIVE IN SOUTH CAROLINA.—The recent report of the African *Eragrostis plana* Nees as a wool-waste introduction in South Caroline makes it desirable to record another unusual alien. My thanks are due to Harry E. Ahles for showing me during April 1966 a large series of specimens from South Carolina localities where wool-waste had been discarded, and to Mr. Ahles and Dr. A. E. Radford for a number of duplicates later sent to SMU in exchange. Among them were numerous species common in Texas, including at least one endemic to the state (*Sida Lindheimeri* Engelm. & Gray). An exotic-looking *Chloris* with elongate, digitate racemes and rather long-awned lemmas was identified by matching with an Australian specimen at SMU of *C. truncata* R. Br., received from the National Herbarium of New South Wales, Sydney: N.S.W., Narramine, *R. Helms*, XI. 1892 (Nat. Herb. N.S.W. No. 31321). The identification was later confirmed by plates and descriptions in vols. 1 and 2 of *Australian Grasses* (Burbidge, 1966 and 1968). Like the African *Eragrostis plana*, this is apparently new to North America. Three specimens are deposited at SMU. SOUTH CAROLINA. Berkeley Co.: waste ground around the Santee Wool Combing Mill, Jamestown on S. C. state route #45, *Harry E. Ahles 25881 with John G. Haesloop*, 20 May 1957. Florence Co.: waste ground around the Wellman Wool Combing Mill, north of Johnsonville on state route #41, *Ahles 42889*, 13 Jun 1958, *Ahles 46959 with J. Haesloop*, 21 Jul 1958.—*Lloyd H. Shinners.*

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(EDITOR'S NOTE: This is the last manuscript of Lloyd H. Shinners to be published.)

SHINNERSOSERIS GEN. NOV. (COMPOSITAE: CICHORIEAE)

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My recent work on *Lygodesmia* revealed several taxa that, although they resemble some of the species in technical characters, do not fit well in the genus (Tomb, 1970a; 1970b; 1972). *Lygodesmia rostrata* (Gray) Gray is another species that does not belong in *Lygodesmia*. I have been reluctant to establish yet another small genus in the North American Cichorieae, since there are at present seven monotypic or ditypic genera in subtribe Stephanomeriinae alone. *Lygodesmia rostrata*, however, has a unique combination of characters and is difficult to place in an established genus. Furthermore, retention of this species in *Lygodesmia* would in my opinion make the genus polyphyletic. Therefore, the establishment of a new genus is required. The principal differences between the new genus, *Shinnersoseris* (*L. rostrata*), and *Lygodesmia* are summarized in Table 1.

TABLE I. PRINCIPAL DIFFERENCES BETWEEN SHINNERSOSERIS AND *LYGODESMIA*

Shinnersoseris	*Lygodesmia*
Lower leaves opposite	Lower leaves alternate
Ligules 0.5-0.7 cm long, ca 1 mm wide, erect, obscure	Ligules 1.0-2.5 cm long, 0.4-1.2 cm wide, reflexed, showy
Style branches short, ca 0.3 mm long, white	Style branches 0.6-4.0 mm long (most species have style branches 2.0-2.5 long), pink-lavender, purple
Achenes 8-10-sulcate, dark brown, narrowed and scabrate below the summit, ab- and adaxial surfaces similar	Achenes variously sculptured (never 8-10-sulcate) pallid, ab- and adaxial surfaces different (except in *L. juncea*)
Pollen echinate, mean equatorial diameter 44μm, tetrads isobilateral	Pollen echinolophate, mean equatorial diameter 46-65μm, tetrads tetrahedral
Base chromosome number, $x=6$	Base chromosome number, $x=9$

CHROMOSOME STUDIES

Stebbins, Jenkins, and Walters (1953) reported the first chromosome count of *Shinnersoseris rostrata* (*Lygodesmia rostrata*) as $2n=12$. Additional

SIDA 5(3): 183-189. 1973.

chromosome counts from 5 populations confirm the original count (Table II). The meiotic chromosome counts were made by using the procedures outlined by Turner and Johnston (1961).

The karyotype of *S. rostrata* (determined from root tip squashes using a 90 min PDB pretreatment and aceto-orcein stain) consists of 6 chromosome pairs, all of almost the same total length. One pair is metacentric, three pairs are submetacentric, and the remaining two pairs are acrocentric (Fig. 3D). Satellites and secondary constrictions were not observed.

TABLE II. CHROMOSOME COUNTS OF *SHINNERSOSERIS ROSTRATA*

Locality & voucher	*n*	2*n*
NEBRASKA. Cherry Co.: Near Big Alkali Lake. *Tomb 557.*	6	
NEBRASKA. Cherry Co.: Neb. Spur 483, 9 mi SW of U.S. 83. *Tomb 560.*	6	
NEBRASKA. Cherry Co.: Entrance Valentine Wildlife Refuge. *Tomb 561.*	6	12
WYOMING. Goshen Co.: 12 mi N of Lingle. *Tomb 581.*	6	12
WYOMING. Goshen Co.: 4 mi E of Fort Laramie. *Tomb 583.*	6	

PALYNOLOGY

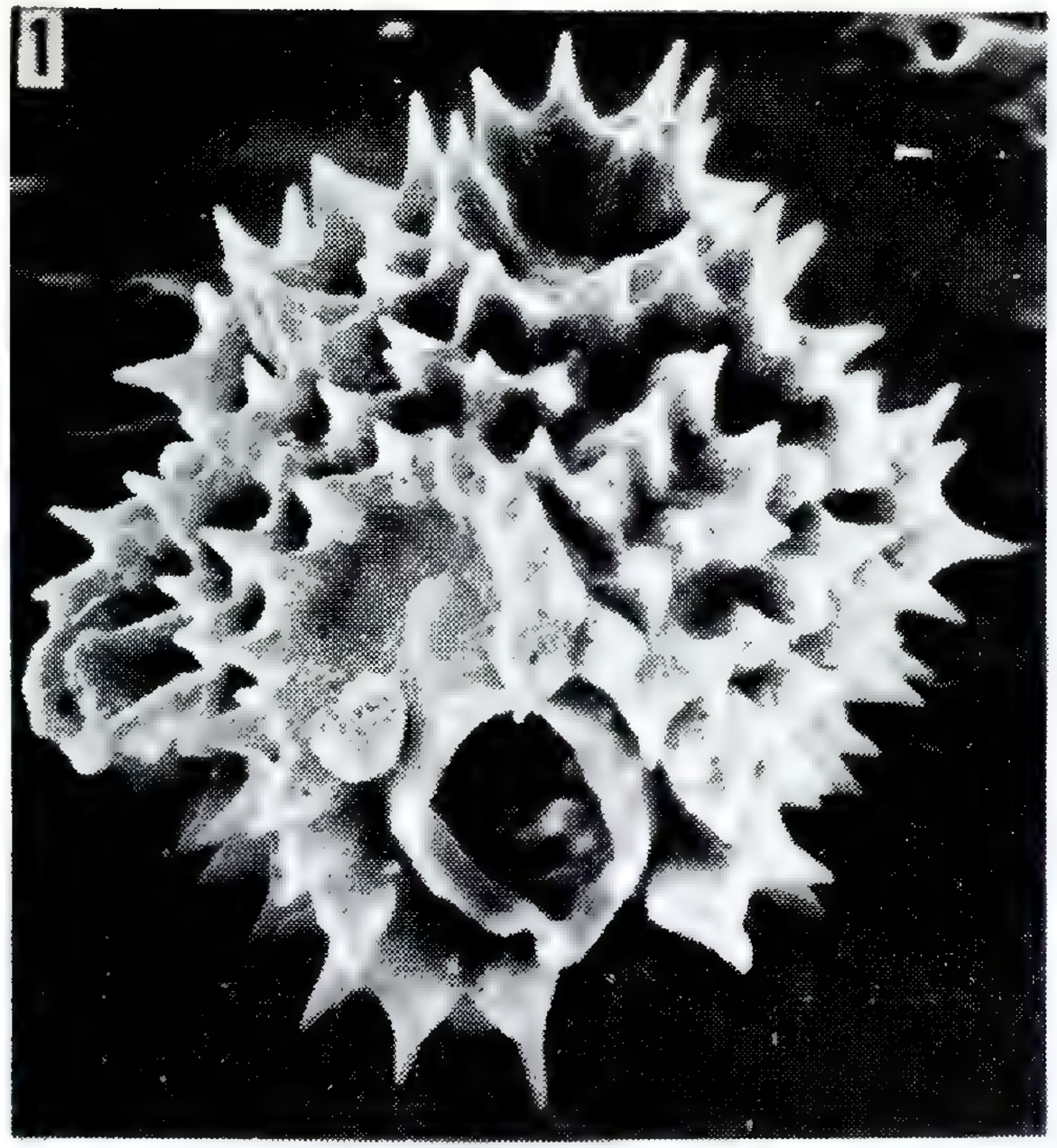
The pollen of *Shinnersoseris rostrata* is echinate, tricolporate (Fig. 1). Although ridges bearing spines are clearly present, the highly ordered echinolophate pattern of *Lygodesmia* and most of the Cichorieae is never approached in *Shinnersoseris*. Sectioned exines of *S. rostrata* reveal a stratification pattern like that found in the Stephanomeriinae (Fig. 2). The electron-dense extexine consists of short spines, a perforate tectum, columellae, and a thin foot layer. A cavus separates the columellar bases from the foot layer. Below the foot layer is the less electrondense endexine. A description of the pollen of *S. rostrata* follows: equatorial diameter 43.7 μm (41.2-47.9 μm); polar diameter 38.2 μm (35.9-39.7 μm); spine length 1.7 μm (1.5-2.3 μm);[1] grains echinate, spherical in polar view, almost spherical in equatorial view; 9 lacunae (3 poral and 6 abporal); polar thickenings large.

The pollen of *S. rostrata* is produced in isobilateral tetrads. Tetrahedral tetrads are found in all of the Stephanomeriinae examined to date. *Shinnersoseris* produces only 30-50 pollen grains per anther. This low pollen production and the nature of the flowers suggest that *S. rostrata* is self-fertile.

[1] Mean values followed by the ranges in parentheses based on measurement of 100 grains from *Tomb 557.*

Fig. 1. Scanning electron micrograph of acetolized *S. rostrata* pollen. Note abporal lacuna above germ pore.

Fig. 2. Transmission electron micrograph of *S. rostrata* exine. B, Foot layer; Ca, Cavus; En, Endexine. Lines in each micrograph equal 1 μm.



1

2

TAXONOMIC TREATMENT

Shinnerseseris Tomb, gen. nov.

Herbae annuae. Folia fasciaria, integra, non rosulata, foliis inferioribus oppositis, foliis superioribus alternis et parvioribus. Capitula terminalia, floribus paucis. Involucra cylindracea, 7 vel 8 bracteis principalibus appendiculatis apicem versus, appendiculis carinoideis; bracteae exteriores breves, 2-seriales, calyculum formantes. Flosculi ligulati, ligulis lavandulaceis, quinquedentatis, per anthesin erectis; rami stylorum breves. Cypselae 8 - 10-sulcatae, subcylindraceae, prope apices abrupte angustatae et scabrellae. Pappus 2-serialis, capillaceus, candidus.

Shinnersoseris rostrata (Gray) Tomb, comb. nov.

Lygodesmia juncea var. *rostrata* Gray, Proc. Acad. Philad. 1863: 69. 1863. HOLOTYPE (GH!): Colorado; "On the plains; Rare." (between latitude 39° and 41°); Sep 1862; *Elihu Hall & J. P. Harbour 347*. Isotypes: GH! NY! From the above latitudinal data, the type was probably collected in the sandhill region of northeastern Colorado.
Lygodesmia rostrata (Gray) Gray, Proc. Amer. Acad. 9: 217. 1874.

Herbaceous taprooted annual, 1.0-8.5 dm tall (usually ca 3.0 dm tall); stems glabrous, green, sparingly branched and not striate in the basal third, becoming paniculately branched and striate in the upper two-thirds; lower leaves opposite for the first 5-8 nodes, not forming a basal rosette, linear, 6-10 cm long, 2-4 mm wide, entire, glabrous, obscurely 1-3 veined; upper leaves similar to lower except alternate, 6 cm or less in length, reduced to linear bracts below the heads; heads several to numerous, of 8-11 florets; involucre narrowly cylindrical, 1.2-1.5 cm long, 3-4 mm wide; the 7 or 8 principal involucral bracts narrowly linear, 1.6-1.9 cm long at maturity, glabrous, the midribs obscure, the apices bearing a small keel-shaped appendage; outer involucral bracts lanceolate, in ca 2 series, forming a calyculum; ligules lavender with white apices, ca 6 mm long, 1 mm wide, erect at anthesis (i.e., not reflexed); corolla tube ca 8 mm long; anthers purple, ca 2 mm long, exserted ca 1.5 mm; style column purple, exserted ca 2 mm above the anthers; style branches white, ca 0.3 mm long; achenes subcylindric, 8-10 sulcate, 0.8-1.0 cm long, abruptly narrowed and scabrate just below the summit; pappus 6-8 mm long, usually bright white (rarely sordid white), basally connate; sap cream colored; pollen grains echinate, tricolporate, apertures lacunate, mean equatorial diameter 44 μm; chromosome number, $n = 6$ (Fig. 3D).

DISTRIBUTION

Sandy stream banks, sand dunes, and sand hills, growing with *Muhlenbergia*, *Oryzopsis*, *Helianthus petiolaris*, and *Liatris squarrosa*, from the Texas Panhandle through the plains to Canada (Fig. 4); 2500-4500 ft; Jul-Oct.
Representative Specimens:

UNITED STATES. COLORADO: Adams Co., near Lakeside, 15 Sep 1910, *Eastwood 136* (COLO, GH, UC, US); Fremont Co., Canon City, sand bar, Arkansas River, Oct 1877, *Brandegee s.n.* (UC); Logan Co., Sterling, 11 Jun

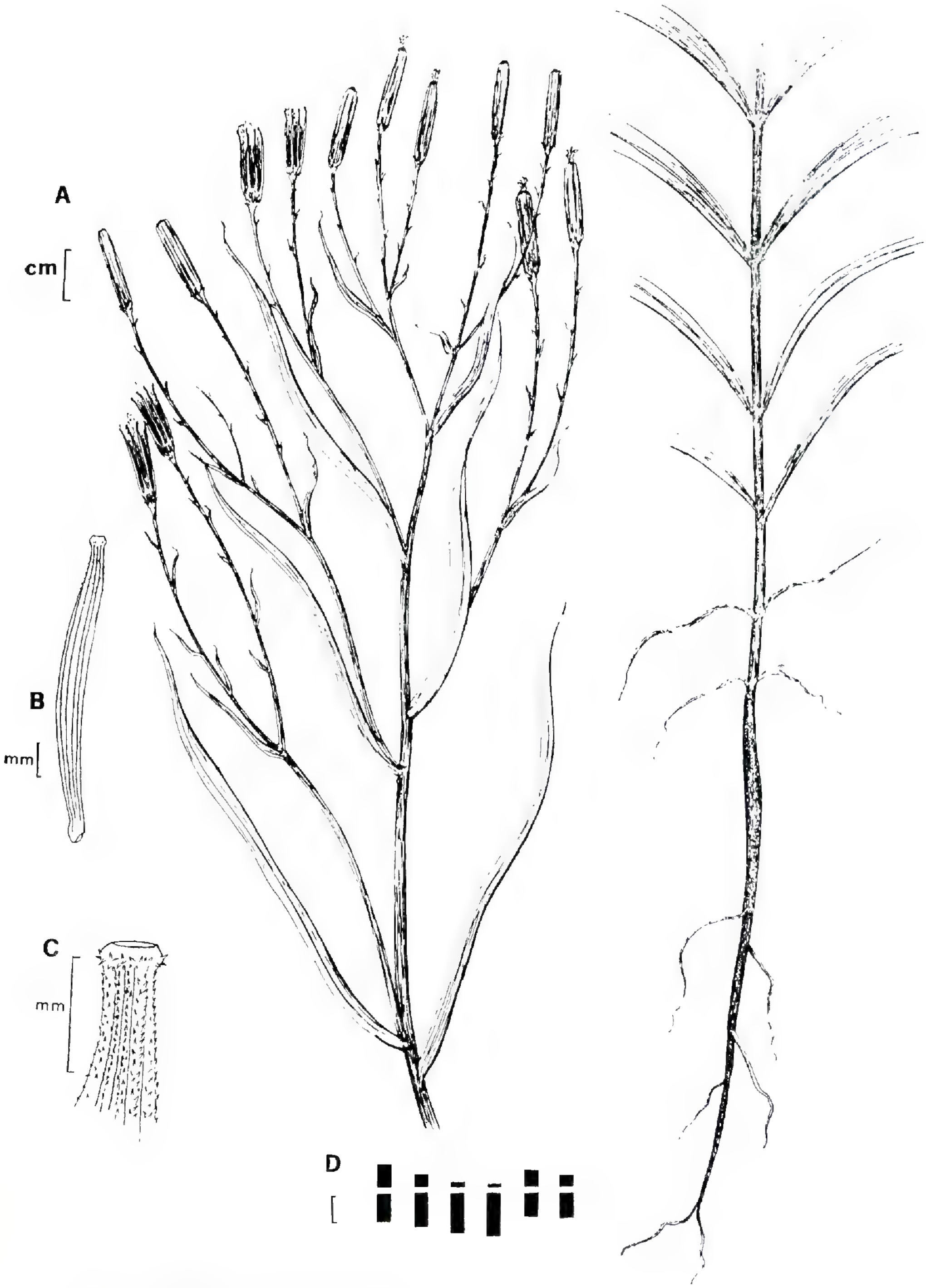


Fig. 3. *Shinnersoseris rostrata*
A. Habit B. Achene C. Achene summit.
D. Idiogram from root tip chromosomes of progeny of *AST 561*. Line equals 5 μm.

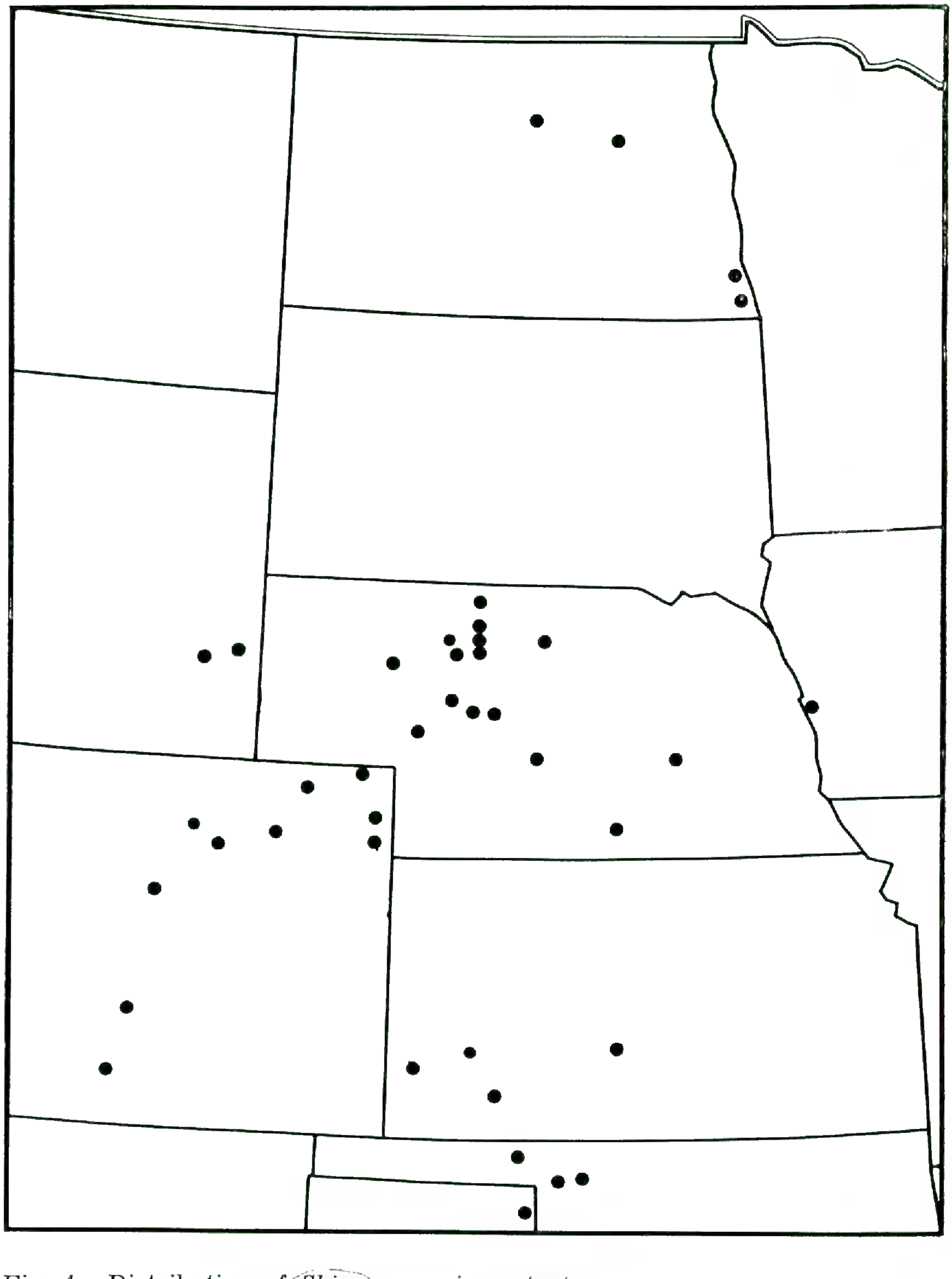


Fig. 4. Distribution of *Shinnersoseris rostrata*.

1896, *Osterhout 1710* (WIS); Morgan Co., 4 mi S of Brush, 15 Sep 1937, *Ramaley & Ewan 16322* (COLO); Phillips Co., 12 mi S of Holyoke, Jul 1949, *Weber 5029* (COLO); Weld Co., New Windsor 29 Sep 1897, *Osterhout s.n.* (NY, WIS); Yuma Co., Wray, 21 Jul 1910, *Osterhout 4333* (NY).

IOWA: Harrison Co., Blair Bridge, sand dunes, Aug 1918, *Shimek s.n.* (NY, WIS).

KANSAS: Finney Co., sand hills, 22 Jul 1912, *Wilson & Miller 4564* (KANU); Hamilton Co., sand hills S of Syracuse, 19 Sep 1912, *Rose & Fitch 17093* (NY, US); Seward Co., 10 mi E of Liberal, 11 Jul 1929, *Hitchcock 1080* (GH, NY, US).

NEBRASKA: Arthur Co., 10 mi S of Arthur, 23 Aug 1947, *Jones s.n.* (WIS); Brown Co., 3 mi W of Johnston-Plum Creek, 29 Aug 1967, *McGregor & Bare 517* (KANU); Cherry Co., Valentine National Wildlife Refuge, 7 Aug 1969, *Tomb 561* (TEX); Custer Co., 17 mi NE of Broken Bow, 12 Sep 1955, *Bergseng & Christensen 209* (WIS); Franklin Co., Thompson Creek N of Macon, 2 Oct 1942, *Egan 14782* (UC); Grant Co., 2 mi W of Ashby, 1 Sep 1965, *McGregor 19690* (KU, UC); Kearney Co., Minden, Sep 1893, *Hapeman s.n.* (ARIZ); Merrick Co., Central, 24 Aug 1893, *Rydberg 1584* (NY); Thomas Co., Middle Loup River near Nattick, 9 Sep 1893, *Rydberg s.n.* (NY, US); Benson Co., Pleasant Lake, 12 Sep 1912, *Lunell 13427* (GH, NY, US); McHenry Co., Denbigh, 18 Aug 1935, *Stevens & Kluender s.n.* (UC, WIS); Richland Co., Leonard, 9 Sep 1936, *Stevens s.n.* (UC).

OKLAHOMA: Major Co., E bank of N Canadian River on Okla 15, 17 Aug 1969, *Tomb 591* (TEX); Woods Co., 4 mi S of Waynoka, 30 Sep 1961, *Rinehart s.n.* (GH, SMU, UC).

TEXAS: Comanche Plains (Canadian River, probably near Texas-Oklahoma border), 1853-1854, *Bigelow s.n.* (GH).

UTAH: Kane Co., near Kanab, 13 Sep 1894, *Jones 6042b* (US).

WYOMING: Goshen Co., 12 mi N of Lingle on US 85, 10 Aug 1969, *Tomb 581* (TEX).

Shinnersoseris superficially resembles *Pyrrhopappus* of subtribe Microseridinae in type of style branches, chromosome number, and to a lesser extent in characters of the achene and involucre. However the pollen of *Shinnersoseris* is like *Stephanomeria*. I favor retension of *Shinnersoseris* in subtribe Stephanomeriinae near *Stephanomeria* pending further study of the Microseridinae.

The genus is named in honor of the late Dr. Lloyd H. Shinners, who was always eager to help a novice ferret out obscure references and publish his work when finished.

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SIDA CONTRIBUTIONS TO BOTANY

VOLUME 5 NUMBER 4 JULY 1974

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SIDA, founded by Lloyd H. Shinners, is privately published by Wm. F. Mahler, SMU Herbarium, Dallas, Texas, 75275, U.S.A. Subscriptions: Libraries—$6.00 (U.S.) per year; individuals—$8.00 (U.S.) per volume; numbers issued twice a year.

ASSOCIATE EDITOR
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SIDA Contributions to Botany, Volume 5 Number 4, pages 191—300.
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A REVISION OF STYRAX (STYRACACEAE) IN NORTH AMERICA, CENTRAL AMERICA, AND THE CARIBBEAN

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The Styracaceae consists of about 12 genera, all small except *Styrax,* and about 150 species centering in eastern Asia, but with numerous species in the New World, none in Australia, one in the eastern Mediterranean region, and about three in Africa. The characters distinguishing *Styrax* from other genera in the family are: stamens 10 or more; flowers perfect, in racemes, cymes, or panicles; ovary completely or almost completely superior; seeds not winged; filaments free or connate only in the lower part; and fruit drupaceous. Two of the genera, *Alniphyllum* and *Pterostyrax* (China and Japan), are considered most closely related to *Styrax. Alniphyllum* differs from *Styrax* in its winged seeds, filaments connate to the top into a tube, and capsular fruit, while *Pterostyrax* differs in its two-thirds to completely inferior ovary (Hutchinson, 1959).

Styrax, a genus of trees and shrubs, is cosmopolitan in its distribution and includes about 120 species, most of which are tropical and subtropical. It occurs in eastern Asia, New Guinea, the eastern Mediterranean region, the Caribbean, South America, Central America, and North America. Ecologically, the species occupy habitats from high mountainous regions to swamps.

Economically and horticulturally the genus is of substantial value. Many species are planted as ornamentals either singly on lawns or in hedges and fencerows. The white-flowered, pendulous racemes and spreading habit make these plants a noteworthy addition to any landscape. In addition to the ornamental value, several species of the Mediterranean region are the source of the aromatic resins styrax and benzoin.

This study is a reappraisal of *Styrax* in North America, Central America, and the Caribbean. The taxonomic status of many of the previously described species is doubtful. Some authors seem to have exploited the genus in order to name new species. This trend is reflected in Standley and Steyermark's (1940) statement describing *Styrax vulcanicola:*

> The most closely related species is the recently described *Styrax magnus* Lundell, of the Volcan de Tacana, Chiapas. In that the shape and size of the leaves suggest *Styrax vulcanicola,* but the pubescence consists of much larger, relatively lax, soft, spreading hairs, making it fairly certain that two distinct species, as species of *Styrax* are divided, are represented.

SIDA 5(4): 191—258. 1974.

These workers appear to have considered it justifiable to use frivolous characters to describe new species because other workers had done so. This trend was set by Perkins (1907), who monographed the genus and caused much confusion by finely and unnecessarily dividing the species complexes. Most species of the United States and Northern Mexico are quite distinct and easily delimited. However, difficulties arise in the southern Mexico and Central American species, primarily the *Styrax argenteus* complex. One of my main objectives is to clarify these matters.

Although this revision is based primarily on morphology, attempts have been made to consider phylogenetic relationships. Approximately 3,500 specimens from 16 herbaria were examined. These were augmented by my personal collection of many specimens from southeastern United States and southwestern Texas.

Complete citations for all species are given, with the exception of *S. americana* var. *americana* and var. *pulverulenta* and *S. grandifolia*. No more than five localities per state are given for *S. americana* var. *americana* and *S. grandifolia*. One locality per county is given for *S. americana* var. *pulverulenta*. Specimens most widely distributed in herbaria were selected for citation. A mimeographed list of collections examined may be obtained from me upon request.

The following herbaria provided *Styrax* specimens—the abbreviations are those of Lanjouw and Stafleu (1959): DUKE, F, FSU, GA, GH, LAF, MO, NCU, NY, OKLA, PH, SMU, TEX, UC, US, and VDB.

Acknowledgements are gratefully extended to the curators who provided specimens for study. I would like to express my sincere thanks to Dr. Robert Kral and Dr. Dean P. Whittier for encouragement and valuable suggestions. Dr. Delzie Demaree freely gave his time in providing collections of *Styrax*, and the late Dr. Lloyd H. Shinners provided valuable references and collections of several rare species. Publication costs were met by the Research Council, East Tennessee State University.

GENERIC HISTORY

"Styrax" is the ancient Greek name for a fragrant resin used as incense and as medicine and for the plant (*Styrax officinalis*) from which it was obtained.

Accounts of *Styrax* were first given by Linnaeus (1735) in *Systema Naturae*. The genus was again treated by Linnaeus in *Species Plantarum* (1753) and *Genera Plantarum* (1754). The type species is *Styrax officinalis*.

Cavanilles (1790) described the genus *Strigilia* from material of *Styrax*. The type species, *Strigilia racemosa*, was later transferred by de Candolle (1844) to *Styrax* as *S. racemosa*.

Ruiz and Pavon (1794) applied the name *Foveolaria ferruginea* to a Peruvian species that was later transferred to *Styrax* by Perkins (1907) under the name *S. foveolaria*.

The generic name *Cyrta* was applied by Loureiro (1790) to an element of

Styrax that was later transferred to *Styrax* under the name *S. agrestis* (Lour.) G. Don (Don, 1838).

The genus *Tremanthes,* described by Persoon (1805), included on publication all species of *Foveolaria* Ruiz et Pavon as well as the type of *Strigilia* Cav.

Perkins (1907) included *Foveolaria ferrugineum, Tremanthes ferrugineum,* and *Strigilia racemosa* in synonymy under *Styrax foveolaria.* If these relationships are true, then the name *S. foveolaria* is incorrect. All four names represent the same taxon, so the name *S. racemosa* (Cav.) A. DC. has priority since the specific epithet *racemosa* is the earliest given to this taxon.

Rafinesque's (1817) *Florula Ludoviciana,* significant as the first localized record of plants in southern Louisiana, was based on Robin's *Voyages dans l'interiere de la Louisiana, de la Florida et dans les Isles de la Martinique.* Robin's *Flore* (a section of *Voyages*) contains descriptions of plants observed by him from Louisiana east to Pensacola, Florida. Many of the plants described are without adequate names. In trying to correct these errors, and in order to place such species into proper relationships, Rafinesque proposed new names for many of the species. Rafinesque made a number of mistakes since he had to work solely from written descriptions and illustrations and since he was not familiar with the flora of the region. In *Florula Ludoviciana* he named what he considered a new genus, *Adnaria,* and its only species, *A. odorata.* Robin had placed this shrub in the "Campanulacees" under *Campanula,* but Rafinesque recognized that it did not belong to that group and suggested that it was a member of the "Vaccinia." Camp (1941) visited the area where *Adnaria* was said to have grown and found and identified the plant as *Styrax americana.* Camp said that the mistake in identification was caused primarily by Robin because Rafinesque was probably not familiar with *S. americana* in the field, but Robin listed and described *S. americana* in his *Flore.*

The generic name *Epigenia* was proposed by Velloso (1825). Shortly thereafter, Schott (1827), transferred all species of *Epigenia* to *Styrax.*

Styrax benzoin was described by Dryander (1787). Hayne (1829) described a new genus, *Benzoin,* the type species being *B. officinalis.* Roxburg (1832), recognized Hayne's error and listed *B. officinalis* as a synonym of *Styrax benzoin.*

The most recent generic name associated with *Styrax* is *Darlingtonia,* published by Torrey in 1851. Torrey(1853) later stated, "and a California plant, on imperfect specimens of which, I had recently indicated a genus under this name, proves to be only a species of *Styrax.*" Torrey's combination, *Darlingtonia californica,* was conserved in this publication and applied to a member of the Sarraceniaceae. The new styrax he named *S. californica.*

During the later part of the 19th and the early 20th century numerous works treated *Styrax* from areas of Norh America, Mexico, and the Caribbean. In addition to large treatments such as those by de Candolle (1844), Bentham and Hooker (1876), Gurke (1897), and Baillon (1892), which all

treated the Styracaceae, the most comprehensive and recent work is the monograph of *Styrax* by Perkins (1907). Perkins confused the taxonomy of the group by describing numerous new species many of which have proved not to be "good" taxa.

MORPHOLOGY

Life Cycle. The following general life cycle was formulated during my study from observations made on *Styrax grandifolia* and *S. americana* (southeastern United States).

The winter buds unfold from late February through early March. The internodes elongate and the leaves expand and reach full size in late March or April. At the same time, the inflorescence develops. Before the winter buds unfold, the synsepalous calyx and the separate corolla lobes and stamens develop more or less simultaneously.

As the leaves reach full size, the corolla begins to project from the calyx. The aestivation of the corolla lobes may be imbricate or valvate depending on the subgenus. The gynoecium has developed by this time, and the lumen is expanded by a mass of tissue that later becomes the placentae.

The flowers generally open about mid-April to mid-May. The period of flowering is normally 2–3 weeks for temperate species and somewhat longer for tropical and subtropical species. The flowers have a faint sweet odor and attract a variety of insects of which various bees seem the most active pollinators. Although the stamens have introrse dehisence, they are reflexed considerably, this causing any visitor to be dusted with pollen. The flowers of most species remain open 3–5 days, after which the corolla lobes lose their turgidity and corolla and stamens are shed. Within a week after the fall of the corollas many ovaries are visibly swollen.

Dissection of an ovary during the early stages of swelling reveals usually one but sometimes two developing ovules. The ovary or young fruit soon expands so as to rupture the calyx and extend beyond it. The fruit ripens from July through September and eventually opens by one or more sutures. The seed coat is primarily a mass of stone cells forming a hard and brittle shell. The cotyledons are large and elliptic. There is a massive hypocotyl, but the plumule is scarcely detectable. The seeds often germinate in close proximity to the parent plant, resulting in dense stands.

Habit. The storaxes are shrubs to medium-sized trees with a rather loose, spreading habit. The numerous, white, fragrant flowers, borne either singly or more often in few-flowered racemes, are followed by drupaceous fruits.

Species of *Styrax* native in the United States are generally large shrubs, occasionally reaching tree size. *Styrax grandifolia* of the eastern United States often has a rather flabellate branching system and a rounded crown. The southwestern Texas and California species are medium-sized shrubs, rough in outline due to a somewhat irregular branching pattern. South through Mexico the species are progressively larger. *Styrax argenteus* of southern Mexico and Central America reaches a height of 30–35 ft., having

a rather freely branched crown and spreading habit. One of the largest species, *S. glaber,* which occurs in the Caribbean, reaches a height of 40 ft. but still has a somewhat spreading habit.

The storaxes are generally understory shrubs or trees in the eastern United States but are often exposed shrubs in the southwestern and western United States. Those reaching tree size in Mexico and Central America often form a substantial part of the forest canopy or forest edge.

Stem. The stems have smooth tight bark to rough flaky bark and may be glabrous to densely pubescent. Cork forms in the inner cortex, which includes a closed or slightly interrupted ring of sclerenchyma. Secondary phloem includes sclerenchymatous elements. The xylem forms a continuous cylinder traversed by narrow rays usually two to four (six) cells in width, markedly heterogenous. In the primary wood the vessels are narrow and scattered, with highly oblique, scalariform perforation plates. The fibers have bordered pits and are of medium length to moderately long. Parenchyma is diffuse and in regular uniseriate lines. The pith is solid. There are intercellular secretory cavities, containing balsamic resins, in the phloem, rays, and wood. Also, crystals of calcium oxalate are present in unlignified tissues (Metcalfe and Chalk, 1950).

Each leaf is supplied by a single vascular bundle, which is accompanied by a single gap in the stele (Sinnott, 1914).

Pubescence. Pubescence in *Styrax* is generally in the form of stellate trichomes, these differing widely in size and structure. The arms of the trichomes vary from especially long and straight as in *S. grandifolia* (Fig. 4d) and *S. argenteus* var. *hintonii* (Fig. 11b), to very short and stout as in *S. americana* var. *pulverulenta* (Fig. 3d) and *S. argenteus* var. *ramirezii* (Fig. 11c).

Four species possess lepidote trichomes: *S. portoricensis* (Fig. 15d), *S. glaber* (Fig. 16d), *S. ochraceous* (Fig. 14d), and *S. conterminus* (Fig. 12d). This type of trichome, very distinctive, is found predominantly on the lower leaf surface in these species. In *S. obtusifolia* of Cuba the lower leaf surface is covered with a light, fine tomentum mixed with scattered lepidote trichomes (Fig. 13d).

Some relationship can be seen in the trichomes of *S. platanifolia* var. *stellata* (Fig. 5f), *S. texana* (Fig. 6g), and *S. youngae* (Fig. 6h). The leaf shape and trichomes of the last two species very closely resemble those of *S. officinalis* var. *fulvescens* (Fig. 7f, 7g). However, *S. officinalis* var. *fulvescens* often has dimorphic pubescence—pale dense tomentum on the lower leaf surface and large dark brown or reddish-colored trichomes on the veins. These species, of rather arid regions, resemble one another in overall appearance.

Styrax jaliscana of northern Mexico might be related to the above-mentioned species. Although its leaves are more elliptic than suborbicular, the leaf texture and general appearance of the plant are very similar to *S. officinalis* var. *fulvescens.* However, its pubescence is woolly, the trichomes (Fig. 8d) having long slender arms very much like those of *S. grandifolia.*

The leaves of *S. youngae* and *S. jaliscana* have uniseriate hairs on the upper surface. These hairs are fairly long and are angled toward the apices of the leaves.

Styrax glabrescens var. *pilosus* bears a striking resemblence to *S. grandifolia* in overall morphology. The pubescence is much heavier on the leaves of the latter species, often becoming woolly, but both species have the same type trichomes with long slender arms (Figs. 9d, 4d).

In the *S. argenteus* complex there is variation in degree of pubescence: var. *ramirezii* (Fig. 11c) has stout trichomes with short arms; var. *hintonii* (Fig. 11b) has trichomes with long slender arms that very much resemble those of *S. grandifolia;* while var. *argenteus* (Fig. 11a) has trichomes of intermediate length.

The degree of pubescence on leaves and on flowering and fruiting structures is used as a major taxonomic character in several species complexes. These include *S. americana* and its variety *pulverulenta, S. plantanifolia* and its variety *stellata, S. argenteus* and its varieties *ramirezii* and *hintonii,* and *S. glabrescens* and its variety *pilosus.*

Leaves. The leaves vary much in size, shape, and texture, ranging from broadly obovate to elliptic-oblong or semi-orbicular and from thin and fine to thick, coriaceous, and revolute. Many of these differences are employed taxonomically in this treatment. Leaf shape and geographic range together are good characters for separating several groups of species. *Styrax grandifolia,* occurring in the eastern United States with *S. americana* var. *pulverulenta*—whose leaves may be also densely pubescent below—can be distinguished from the latter species by its rather large, obovate leaves in marked contrast to the smaller elliptic leaves of var. *pulverulenta.* The suborbicular leaves of *S. plantanifolia,* a species of southwestern Texas and northern Mexico, are distantly toothed toward the apices and cannot be confused with any other species in this study.

Stomata are confined to the lower leaf surface. The vascular bundles of the smaller veins are accompanied by sclerenchyma. A transverse section through the distal end of the petiole reveals a median, cylindrical, vascular strand flattened towards the adaxial surface. Solitary and clustered crystals, probably of calcium oxalate, are reported to occur, especially around the vascular bundles (Metcalfe and Chalk, 1950).

The epidermal pattern of the leaves of *Styrax* is of both the regular- and the irregular-celled type. Although it is not likely that epidermal-cell form could be used as a specific taxonomic character, it is possible to see affinities between species said to be closely related. A study of epidermal cells reveals some possible relationships between the species of *Styrax.*

In addition to the stellate pubescence, occasional scattered glands occur on the lower leaf surface. These glands, rather flattened and circular, are composed of from five to eight small cells surrounding a central depressed area; the function is unknown.

A leaf-clearing technique, including the tannic acid-ferric chloride stain-

ing procedure of Foster (1934), was used for studies on the epidermal cells.

Flowers. The inflorescenses are terminal or axillary, and have numerous white- or cream-colored, fragrant, often pendulous, solitary or racemose flowers. The pedicel of each flower is subtended basally by minute leaflike bracts. These bracts often also occur midway on the pedicel and on the calyx. The length of the bracts varies with the species.

The calices of *Styrax* are campanulate, with the lobes reduced to teeth. The teeth vary from five to seven and range from inconspicuous as in *S. argenteus* to long acute-acuminate as in *S. jaliscana.* The calyx surfaces vary from glabrous and smooth, as in *S. americana* var. *americana,* to densely stellate pubescent, as in *S. argenteus* var. *hintonii.* The size of the teeth and the presence or absence and degree of pubescence may be used as taxonomic characters. The calices are persistent on the drupaceous fruits.

The corolla is sympetalous, the tube being from 3–5 mm long. For this distance the stamens are completely adnate to the tube. The white- or cream-colored lobes number usually five, occasionally six. They are linear-oblong to elliptic-oblong or obovate and range, depending on the species, from 5 mm to 2.8 cm long. The lobes may remain straight, partially open, or widely flared, or the apices may be strongly reflexed. An unusual condition exists in *S. ochraceus* in that the lobes, up to 2.8 cm long and sympetalous basally, are partially fused for two-thirds their length with the apices reflexed. The effect is that of a long salverform corolla.

Perkins (1907) divided *Styrax* into two sections, *Eustyrax* and *Foveolaria. Eustyrax* includes those species having 16–24 ovules per ovary while *Foveolaria* includes those having 3–5 ovules per ovary. *Eustyrax* was divided into two series, *Valvatae* and *Imbricatae. Valvatae* represents those species having valvate dehiscence of the corolla lobes; *imbricatae,* those with imbricate dehiscence. The species in *Valvatae* has lobes that are rather thick, often with a reddish tint on the inner surface. These include *S. argenteus* and its varieties, *S. conterminus, S. portoricensis, S. obtusifolia,* and *S. glaber.* The other species included in this study are in *Imbricatae;* their corolla lobes are rather thin and have the same color and texture on both surfaces.

A nectary was not detected at the base of the corolla; however, the flowers are often aromatic and attract a variety of insects. Copeland (1938) reports, of *S. officinalis* var. *californica,* that minute drops of liquid have been seen on the distal part of the ovary, but no taste of nectar was detected.

The stamens are usually twice as many as the corolla lobes, monadelphous in a short tube basally, 4–6 mm long, and adnate to the sympetalous corolla tube but extending just beyond it. *Styrax ochraceus,* which characteristically has long corolla lobes, has filaments fused nearly the entire length of the partially-fused corolla lobes.

The anthers are basifixed, with linear introrse dehiscence. The filaments are flattened and often stellate pubescent. The pollen, yellow and tricolpate, varies little in size, shape, and texture among the species.

The filiform style, exserted 1–3 mm past the stamens and about as long

as the corolla lobes, is usually glabrous but may be partially stellate-pubescent. The stigma is inconspicuously 3-lobed.

Fruit. The drupes, globose to oblong to broadly elliptic, are dry, loculicidally 3-valvate, and irregularly dehiscent or indehiscent. The one or rarely two seeds are subglobose to ellipsoidal with a basilateral hilum and a hard, smooth, or wrinkled testa. The cotyledons are large and elliptic, the hypocotyl is massive and the radicle and plumule are small.

The calyx is persistent. In several species the style, or part of it, remains on the fruit as an apiculation. Fruit characteristics are not generally used as taxonomic criteria in *Styrax*. *Styrax portoricensis*, however, has fruits so large that it cannot be confused with any other species in this study.

POLLINATING AGENTS

The flowers of *Styrax* are considered to be entomophilous. The anther sacs have longitudinal, introrse dehiscence, which is usually associated with self-pollination. However, the anther sacs are strongly reflexed, so that any visitor becomes dusted with pollen. Also, the style is longer than the stamens, which suggests an outbreeding system. Some wind pollination may also occur.

The pendant flowers are fragrant, and the rather wide, partially reflexed petals provide adequate landing sites for insects. Pollinators were observed on *S. americana* and on *S. grandifolia*. The following insects were most prevalent visitors:

Hymenoptera
- *Apis mellifera*—Honey bee
- *Bombus* spp.—Bumble bees
- *Anthophora* spp.—Solitary bees
- *Prosopis* spp.

Lepidoptera
- *Danaus plexippus*—Monarch butterfly
- *Eurema nicippi*—"Sleepy orange"

Diptera
- Fam. Blepharoceridae—The net-winged midges
- Fam. Drosophilidae
  - *Drosophila* spp.—Fruit flies

Thysanoptera
- *Thrips tritiea*—Thrips

Of the Hymenoptera, *Apis mellifera* is the most frequent visitor, with several species of bumble bee next. The bumble bees have a more difficult time landing on the flowers than do smaller insects because the lax racemes do little to support their weight. Although the flowering period of *S. americana* and *S. grandifolia* lasts 2–3 weeks, insect visits are mostly during the first week. Those pollinators listed above were common on both species; however, more *Drosophila* frequented *S. americana*.

CYTOLOGY

Chromosome counts for several species of *Styrax* are found in the literature. Counts for *S. obassia* and *S. japonica* of Japan were made by Mansard (1936). In addition, chromosome counts for *S. officinalis* var. *californica* were made by Copeland (1938), and for *S. officinalis* var. *fulvescens* by Raven *et al* (1965). These counts are listed in Table 1.

During my study I attempted to obtain chromosome counts for *Styrax* of eastern United States, including *S. grandifolia*, and *S. americana* var. *americana* and var. *pulverulenta*. The counts were based solely upon pollen mother cell smears of freshly gathered material and are listed in Table 1.

The base number for *Styrax* is $n=8$. *Styrax grandifolia* was found to have a haploid number of 16 (Fig. 1c) and is, therefore, a tetraploid. Both *S. americana* var. *americana* and var. *pulverulenta* were found to have a haploid number of 8 (Fig. 1a, 1b), making them diploids.

The relationship between the eastern species of *Styrax* is confusing. It seems that the morphological distinctness of the taxa is maintained by internal rather than external isolating factors. Although the geographical ranges are sympatric, the ecological ranges rarely overlap. *Styrax grandifolia* is more prevalent on rather dry, well-drained, sandy soils, commonly on slopes. It covers a wide range, most of which it shares with *S. americana*. Where the ecological ranges overlap there is no indication of hybridization between the species.

There are at least two possible origins of *S. grandifolia*. Wood and Channell (1960) noted that *S. glabrescens*, whose range includes northern Mexico, is a close relative of *S. grandifolia*. No chromosome counts are available for *S. glabrescens*, but the two species show very close morphological resemblance. *Styrax grandifolia* also resembles *S. officinalis* and has been misidentified as this species—as in Walter (1788). The resemblance to *S. officinalis* is indeed striking on some specimens collected on high, well-drained, sandy soils. *Styrax officinalis* (a known diploid) is principally a Mediterranean species whole range also includes California. It may have ranged further east in North America in ages past. *Styrax grandifolia* could have arisen as an allo- or autotetraploid from the above species or possibly from *S. americana*. Further work on the genomic characteristics is necessary to make any definitive statements.

The origin of *S. americana* is even more perplexing. Other than *S. japonica*, there are no other species that, on morphological grounds, would have given rise to *S. americana*. *Styrax japonica*, a pentaploid whose range does not include North America, seems a most unlikely ancestor.

A great deal more cytological work needs to be done in order to assemble conclusive evidence of the evolutionary relationships of the species of *Styrax*.

As with many woody plants, it was rather difficult to determine the chromosome number, and it was only after many attempts that the counts for *S. grandifolia* and *S. americana* were obtained. There seems to be a very narrow time range within which meiosis occurs in *Styrax*.

TABLE I. Chromosome Counts ($2n$) for *Styrax*.

Species	$2n$ Number	Source of Count
Styrax obassia	16	Manshard (1936)
Styrax officinalis var. *californica*	16	Copeland (1938)
Styrax officinalis var. *fulvescens*	16	Raven *et al.* (1965)
Styrax americana var. *americana*	16	Gonsoulin (Louisiana: Washington Parish. Bogalusa. *Gonsoulin 1032*, 28 May 1969; flower buds collected 7 Mar 1970, 15 Mar 1972. NY, PH, SMU, US, VDB).
Styrax americana var. *pulverulenta*	16	Gonsoulin (Alabama: Baldwin Co. Foley. *Gonsoulin 1964*, 20 Mar 1973. Herbarium of East Tennessee State University).
Styrax grandifolia	32	Gonsoulin (Tennessee: Lewis Co. Gordonburg. *Gonsoulin 1022*, 3 May 1969; flower buds collected 6 Apr 1969. NY, PH, SMU, US, VDB).
Styrax japonica	40	Manshard (1936)

SYSTEMATIC TREATMENT

Styrax Linnaeus, Syst. Nat. ed. I. 1735; Gen. Pl. ed. I. 143. 1737; Sp. Pl. 444. 1753; Gen. Pl. ed. 5. 203. 1754.

Cyrta Lour., Fl. Cochinch. 278. 1790.

Foveolaria Ruiz and Pavon, Fl. Peruv. Chil. Prodr. 57, t.9. 1794.

Strigilia Cav., Monadelph. Class. Diss. 7:358, t. 201. 1790.

Tremanthus Pers., Syn. Pl. 1:467. 1805.

Adnaria Raf., Fl. Ludovic. 56. 1817.

Epigenia Vell., Fl. Flum. 183. 1825.

Benzoin Hayne, Getr. Darst. Beschr. Arzneyk. Gew. 11, t. 24. 1829.

Darlingtonia Torr., Proc. Amer. Acad. Arts 4:191. 1851.

Shrubs or small trees of warm or temperate areas of the Americas and Eurasia. Leaves alternate, estipulate, commonly deciduous, entire or serrate-serrulate, broadly ovate-obovate to elliptic-lanceolate, densely stellate-pubescent to glabrous; apices mostly acute-acuminate; bases cuneate to rounded. Flowers perfect, 5-merous, in pendulous racemes in the axils of the leaves and/or on terminal branches; pedicels glabrous to densely stellate pubescent; calices campanulate, truncate, gamopetalous, 5–7-denticulate, glabrous to canescent or densely stellate-pubescent, fused basally, imbricate or valvate in the bud, eventually spreading or recurved. Stamens usually twice as many as the corolla lobes; filaments flattened, basally monadelphous, inserted near the base of the corolla; anthers oblong, basifixed, with linear dehiscence. Ovary about half inferior to superior, 3-locular toward the

base, 1-locular above, ovules few to many in each locule; style simple, as long as or longer than stamens; stigma capitate, smooth or slightly lobed. Fruit globose to ovoid-oblong, dry, crustaceous, usually 1-seeded, irregularly dehiscent to indehiscent, basally surrounded by the persistent calyx. Seeds 1 or rarely 2, subglobose or elliptical with a basilateral hilum; testa hard, smooth or faintly wrinkled.

Type species: *Styrax officinalis* L.; common name: "Snow-bells."

There are about 120 species in the genus, most of them tropical and subtropical, in eastern Asia to New Guinea. (absent from the Philippines and Ceylon), the eastern Mediterranean region, South America, the West Indies, and Central and North America. Ten taxa occur in the United States, four of them varieties.

Parts of the following key were modified from keys of previous workers. These include the Series *Valvatae* and *Imbricatae* recognized by Gurke (1897) and Perkins (1907).

Key to North American,
Central American, and Caribbean
Styrax

1a. Corolla lobes predominantly valvate in aestivation. . . . Series 1. *Valvatae*
1b. Corolla lobes predominantly imbricate in aestivation.
. . . . . Series 2. *Imbricatae*

Series 1. *Valvatae* Gurke

1a. Lower surfaces of the leaves covered either with long spreading stellate trichomes, or dense, matted or otherwise tomentose pubescence.
. 2
1b. Lower surfaces of the leaves glabrous or covered with scattered to dense lepidote pubescence. 3
2a. Leaves 7–14 cm long, oblong-elliptic, covered below with dense matted pubescence to dense long spreading stellate trichomes, apices short acuminate; mature flowers 13–17 mm long; central Mexico through Central America (Figs. 10 & 11). . . . . 9. *Styrax argenteus*
2b. Leaves 3–4 cm long, oblong to obovate, covered below with dense matted pubescence, apices rounded to acute; mature flowers 7–9 mm long; Cuba and Haiti (Fig. 13). . . . . 11. *Styrax obtusifolia*
3a. Leaves glabrous to covered with scattered lepidote pubescence below, the trichomes not commonly overlapping each other. 4
3b. Leaves completely covered below with lepidote pubescence imparting a crusty appearance. 5
4a. Leaf blades obovate-elliptic, 2–5 cm long, apices rounded to acute; mature flowers 2.5–3.4 cm long; drupes 8–10 mm long; Dominican Republic (Fig. 14). . . . . 12. *Styrax ochraceus*
4b. Leaf blades elliptic, 6–12 cm long, apices short acuminate; mature flowers 1.6–2 cm long; drupes 2.5–3.5 cm long; throughout Puerto Rico (Fig. 15). . . . . 13. *Styrax portoricensis*

5a. Mature flowers 12–15 mm long; drupes oblong-elliptic, slightly asymmetrical, 12–15 mm long; Central America (Fig. 12). 10. *Styrax conterminus*
5b. Mature flowers 2–2.4 cm long; drupes ovoid to globose-ovoid, 2 cm long; throughout the British West Indies (Fig. 16). . . . 14. *Styrax glaber*

Series 2. *Imbricatae* Gurke

1a. Leaves orbicular to suborbicular or oblong-ovate; apices rounded to acute 2
1b Leaves narrowly to broadly elliptic or obovate, apices acute to long acuminate. 7
2a. Leaves glabrous or having sparse scattered coarse stellate pubescence. 3
2b. Leaves with fine, dense, silvery indumentum to woolly white or grayish tomentum. 4
3a Leaves irregularly lobed or toothed toward the apices; calices glabrous to finely puberulent, apices glandular and prominently toothed; Edwards Plateau, Texas, U.S.A. (Fig. 5). . . . . 3. *Styrax platanifolia*
3b. Leaves not irregularly lobed or toothed toward the apices, lower surfaces glabrous to fulvescent; calices puberulent to fulvescent, apices non-glandular; Mediterranean region and California, U.S.A. (Fig. 7). . . . . 6. *Styrax officinalis*
4a. Calices densely puberulent, their apices glandular tipped; leaves bright silvery below with a very fine and dense indumentum; Edwards Plateau, Texas, U.S.A. (Fig. 6). . . . . 4. *Styrax texana*
4b. Calices and lower leaf surfaces not as above. 5
5a. Lower leaf surfaces covered with dense woolly white tomentum, prominently veined; calices pale densely tomentose, the teeth very large, broadly acute; from Baja California through Central America (Fig. 8). . . . . 7. *Styrax jaliscana*
5b. Lower leaf surfaces grayish tomentose to fulvescent; calices dark brown, the teeth wanting to moderately long and acuminate-attenuate. . . 6
6a. Upper surfaces of the leaves covered with long spreading stellate trichomes, lower surfaces grayish tomentose; calices 4–5 mm long, 4–5 mm wide, teeth wanting to 0.4 mm long, style with stellate trichomes about 2/3 up from base; northern Mexico and the Davis Mts., Texas, U.S.A. (Fig. 6). . . . . 5. *Styrax youngae*
6b. Upper surfaces of the leaves covered with short, close, stellate trichomes, lower surfaces having rufous, fulvescent pubescence, calices 5–7 mm long, 6–7 mm wide, teeth wanting to 1.2 mm long; style with stellate trichomes to ½ way up from base; Mediterranean region and California, U.S.A. (Fig. 7). . . . . 6. *Styrax officinalis*
7a. Leaves generally broadly obovate, sometimes broadly ovate, apices acute to short acuminate, densely and finely tomentose below imparting a pale color; southeastern U.S.A. (Fig. 4). . . . . 2. *Styrax grandifolia*
7b. Leaves narrowly to broadly elliptic, apices short to long acuminate, glab-

rous or sparsely to densely pubescent below, but when so imparting a rusty color. 8

8a. Leaves narrowly elliptic, usually 2–8 cm long, petioles 3–5 mm long; flowers 13–16 mm long, calices glabrous to densely pubescent; drupes 6–8 mm in diameter; southeastern U.S.A. (Fig. 2 & 3). . . . . 1. *Styrax americana*

8b. Leaves broadly elliptic, usually 8–12 cm long, petioles 6–10 mm long; flowers 16–21 mm long, calices stellate pilose with rufous hairs; drupes 8–12 mm in diameter; central Mexico (Fig. 9). 8. *Styrax glabrescens*

1. STYRAX AMERICANA Lamarck

Key to Varieties

Leaves oblong-elliptic, glabrous or sparsely trichomiferous on the undersurfaces and petioles, margins usually distantly toothed toward the apices; pedicels 10–14 mm long, calices 3–4 mm long, both essentially glabrous; new shoot growth and racemes glabrous to sparsely pubescent (Fig. 2). . . . . 1a. *S. americana* var. *americana*

Leaves elliptic to ovate, sparsely to densely scurfy-hairy on the undersurfaces and petioles, margins entire to serrate; pedicels 4–6 mm long, calices 3–4 mm long, both densely scurfy-hairy; new shoot growth and racemes rather densely matted pubescent (Fig. 3). 1b. *S. americana* var. *pulverulenta*

1a. *STYRAX AMERICANA* Lamarck var. *AMERICANA*, Encycl. Meth. Bot. 1:82, 1783.

Styrax laeve Walt., Fl. Carol. 140. 1788.

Styrax glabrum Cav., Monadelph. Class Diss. 6:340, t. 188. 1790.

Styrax laevigatum Ait., Hort. Kew. 2:75. 1789.

Styrax octandrum L'Her., Stirp. Nov. 2:t. 17 ex. Aiton, Hort. Kew. 2:75. 1789.

Halesia parviflora sensu Dindl., Bot. Reg. 11:t. 952. 1825, (non Michx. 1803).

Adnaria odorata Raf., Fl. Ludovic. 56. 1817.

Styrax americanus fma. *genuinus* Perkins, Pflanzenreich IV. 241 (Heft 30): 76. 1907.

Branded shrub, 1–4 m high. Leaves usually glabrous, blades oblong-elliptic, often ovate, 2–10 cm long, margin entire to serrate or distantly toothed, the bases cuneately narrowed, apices acute or short acuminate; upper surfaces dark green, glabrous; lower surfaces pale green, glabrous to faintly pubescent; petioles 3–5 mm long, glabrous to slightly pubescent. Flowers either solitary in the axils of the leaves or in axillary, semi-drooping, 2–7 flowered racemes; pedicels 10–14 mm long, glabrous to slightly pubescent; calices 3–4 mm long, pale, glabrous to slightly pubescent, teeth small, acute; corolla lobes 10–12 mm long, elliptic-oblong or lanceolate-oblong, lightly soft downy pubescent; stamens about as long as the corolla lobes; filaments short

pubescent on the proximal 1/3; anthers 1/3 the length of the stamens; style glabrous, about 1 mm longer than stamens; stigma barely if at all lobed. Drupes subglobose or obovoid, 6–7 mm in diameter, sparsely tomentose, style not persistent; seeds usually 1, globose, dark brown, dull (Fig. 2).

Found in rich soils, low, moist sites such as stream banks, floodplains, and margins of swamps. It ranges from northeastern West Virginia to southern Florida, westward along the Gulf Coast into eastern Texas, then north to southern Missouri, southern Illinois, southern Indiana, and Ohio (Fig. 17).

The usual flowering time for var. *americana* is from April through May; however specimens collected in Louisiana had flowers and fruit on the same branch as late as September. The colloquial name is "American snow-bell."

Holotype: U.S.A. *CAROLINAS AND GEORGIA. Michaux.* Herbarium Richard (PC; isotype, PC!).

UNITED STATES—ALABAMA. Blount Co.—Cullman, *Kral 26659* (VDB). Dale Co.—Brandidge, *Gonsoulin 1226* (NY, PH, SMU, US, VDB). Geneva Co.—Sampson, *McDaniel 8924* (FSU, VDB). Lee Co.—Auburn, *Baker 6438* (MO, NY, UC), *Earle & Baker*, 4 Apr 1893 (F, GH, MO, NY).

ARKANSAS. Ashley Co.—Hamburg, *Demaree 14705* (GH, MO, NY, SMU). Cross Co.—McDonald, *Gonsoulin 1043* (NY, PH, SMU, US, VDB). Desha Co.—Pendleton, *Gonsoulin 1040* (NY, PU, SMU, US, VDB). Drew Co.—Monticello, *Demaree 13673* (GH, MO, NY). Perry Co.—Nimrod, *Demaree 46444* (DUKE, SMU).

DISTRICT OF COLUMBIA. Washington, *L. Ward,* 24 May 1881 (GH), *G. Vasey* (F).

FLORIDA. Calhoun Co.—Blountstown, *McDaniel 8744* (FSU, VDB). Dixie Co.—Cross City, *Small*, 25 Apr 1921 (GH, NY, UNC). Gadsden Co.—River Junction, *Harbison 1485* (GH, UNC). Levy Co.—Otter Springs, *Kral 4089* (FSU, SMU, UNC, VDB). Okaloosa Co. Laurel Hill, *Godfrey 61624* (FSU, SMU).

GEORGIA. Baldwin Co.—Milledgeville, *Harbison 1550* (GH, UNC). Charlton Co.—Mattox, *Gonsoulin 1233* (NY, PH, SMU, US, VDB). Crisp Co.—Cordele, *Moore & Lauren 664* (FSU, GA). Dougherty Co.—Albany, *Gillspie 4972* (GH, SMU, UC). Gwinett Co.—McGuires Mill, *Small,* 7 May 1895 (F, GH, NY).

ILLINOIS. Alexander Co.—Cache, *Palmer 14935* (GH, MO). Johnson Co.—Grantsburg, *Winterringer 1951* (TEX). Massac Co.—Metropolis, *Gleason 2554* (GH). Pope Co.—Golconda, *Bauer*, 31 May 1940 (F). Pulaski Co.—Karnak, *Palmer 15119* (GH).

INDIANA. Huntington Co.—Huntington College, *Henderson*, 5 May 1959 (FSU). Lake Co.—Schnieder, *Deam 36493* (GH). La Porte Co.—La Cross, *Deam 38780* (GH, PH). Porter Co.—Baum Bridge, *Deam 34864* (GH, NY). Posey Co.—Mt. Vernon, *Hermann 6671* (F, NY).

KENTUCKY. Marshall Co.—*McCoy*, 5 Jul 1939 (UC). Muhlenberg Co.—*Price 2118* (MO). Union Co.—Caney Mound School, *Shacklette 346* (GH, NY).

LOUISIANA. Avoyelles Par.—Marksville, *Gonsoulin 1035* (NY, PH, SMU, US, VDB). Caldwell Par.—Columbia, *Thomas & Gilliam 2934* (LAF, UNC). Iberia Par.—Weeks Island, *Thieret 17065* (DUKE, FSU, LAF, TEX). Livingston Par.—Georgeville, *Thieret 27117* (DUKE, FSU, LAF). Ouachita Par.—Cheniere, *Kral 20036* (VDB).

MISSISSIPPI. Calhoun Co.—Skuna River, *Gonsoulin 1028* (NY, PH, SMU, US, VDB). Harrison Co.—Harrison, *Jones 14722* (SMU, TEX). Handsboro, *Demaree 32507* (SMU, UNC, VDB). Jackson Co.—Ocean Springs, *Skehan*, 22 Apr 1895 (GH, MO, UC). Lamar Co.—Purvis, *Jones 7982* (GA, GH, FSU, UNC).

MISSOURI. Butler Co.—Neelyville, *Eggert*, 8 Aug 1893 (F, GH, NY, UC), *Redfearn & Eggers 14538* (FSU, GA, UNC, LAF). Dunkin Co.—Campbell, *Cunningham*, 20 Jun 1934 (GH). Pipley Co.—Naylor, *Palmer & Steyermark 41574* (MO, NY, PH). Stoddard Co.—Advance, *Steyermark 20835* (MO).

NORTH CAROLINA. Bladen Co.—Clarkston, *Gonsoulin 1123* (NY, PH, SMU, US, VDB). Buncombe Co.—Biltmore, *4669a* (GH, MO, NY). Cumberland Co.—Fayetteville, *Holmes*, 13 Apr 1921 (FSU, UNC). Gates Co.—Chowan R., *Fernald 11605* (DUKE, GH); Camels Creek, *Radford 5678* (GH, UNC). Johnston Co.—Smithfield, *Radford & Stewart, 200* (NY, SMU, UC, UNC).

PENNSYLVANIA. Lancaster Co.—Lancaster, *Small*, Jul 1889 (F).

SOUTH CAROLINA. Anderson Co.—Tugaloo R., *Radford 12067* (GA, GH, NY, UNC, VDB). Beauford Co.—Buffton, *Millichamp*, Apr 1880 (GH, MO, NY). Berkeley Co.—Santee R., *Little & Wood 14314* (UNC); Bonneau, *Godfrey 478* (GH, F, MO, NY, UC). Chesterfield Co.—Bay Forest, *Radford 12304* (UC, UNC).

TENNESSEE. Hamilton Co.—Chicamauga Lake, *Gonsoulin 1242* (NY, PH, SMU, US, VDB). Haywood Co.—Shepard, *Palmer 17473* (GH, MO). Madison Co.—Jackson, *Bain 133* (NY, UNC). Obion Co.—Troy, *Fairchild 8387* (GA); Obion, *Sharp 7853* (DUKE, FSU, GH, NY, SMU, TEX, UNC, UC).

TEXAS. Jasper Co.—Jasper, *Correll 15337* (FSU, UNC). Liberty Co.—Doleu Swamp, *Young*, 21 Apr 1914 (TEX). Marion Co.—Smithland, *Correll*, 29 Jul 1967 (UC). Newton Co.—*Allen 39050* (TEX). Polk Co.— (collector unknown) *4670*, 27 Apr 1903 (NY). San Augustine Co.—San Augustine, *Palmer 13256* (GH, MO).

VIRGINIA. Charles City Co.—Chickahominy River, *Fernald 13391* (GH). Henrico Co.—Elke Station, *Fernald 9394* (F, GH, MO). Isle of Wright Co.—Joiners Bridge, *Harvill 13847* (SMU, UNC). Southhampton Co.—Franklyn, *Fernald 10780* (F, GH, MO). Sussex Co.—Kello's Dam, *Fernald 14951* (GH).

Styrax americana is a well-marked species not easily confused with the sympatric *S. grandifolia*. However, there exists a considerable range of morphological variation between *S. americana* and var. *pulverulenta*. Characters separating the two are based on a difference in pubescence on the lower surface of the leaves, on the pedicels, on the calices, and on new shoot growth. Also used is the length of the pedicels, var. *americana* having a much larger pedicel-calyx ratio. The two are often found growing in the same

habitat, although var. *pulverulenta* is more often found on higher, slightly more sandy soils than is var. *americana*. Variety *pulverulenta* is slightly more southern in its range, reaching a northernmost extension in central Arkansas eastward. These two taxa seem to be hybridizing and backcrossing wherever their habitats overlap. Intermediates are often more numerous than either of the two well-defined varieties, and positive identification may be impossible. The leaves on any specimen of "good" var. *americana* are glabrous and larger than those of a "good" *pulverulenta* in addition to being toothed toward the apices. Leaves of the latter variety are smaller than those of the former and are densely scurfy-hairy on the undersurfaces and petioles. In addition, var. *pulverulenta* has pedicels barely if at all longer than the calices, and these are also densely scurfy-hairy. This is in contrast to the long, glabrous pedicels of var. *americana*. In areas where the two varieties overlap the characters used in their definition are absent or possessed to various degrees; that is, the states of the characters differ for different specimens. To solve this problem I employed series of characters, each weighted equally in a manner similar to that used in numerical taxonomy. This method offers the best solution for defining the two varieties in the areas of overlap, although as expected there are some specimens that remain doubtful.

1b. *STYRAX AMERICANA* Lamarck var. *PULVERULENTA* (Michaux) Rehder, Bailey Stand. Cycl. Hort. 6:3280. 1917.

Styrax pulverulentum Michx., Fl. Bor.-Amer. 2:41. 1803.

Styrax americanum fma. *pulverulentum* (Michx.) Perkins, Pflanzenreich IV. 241 (Heft 30): 76. 1907.

Leaf blades elliptical to oval, ovate or obovate, 2–10 cm long; upper surfaces dark green, glabrous or with a few scattered trichomes near the veins; lower surfaces paler, finely to densely scurfy-hairy to tomentose; petioles 3–5 mm long, densely pubescent. Pedicels 4–6 mm long, densely scurfy-hairy; calices pale, 3–4 mm long, densely to moderately pubescent, teeth small, acute; corolla lobes 8–10 mm long, elliptic-oblong or lanceolate-oblong, lightly soft downy pubescent (Fig. 3).

Styrax americana var. *pulverulenta* generally occupies slightly drier, better-drained alluvial soils than does var. *americana*. It is, however, found in very wet sites growing near the latter species, hybridizing and backcrossing with it. It ranges from South Carolina, south throughout Florida, and westward along the Gulf Coast, and into eastern Texas, then north into Arkansas and southern Missouri (Fig. 17).

The usual flowering time for var. *pulverulenta* is April through May, but, as does var. *americana*, it exhibits seasonal variation. The colloquial name is "Downy American snow-bell."

Holotype: U.S.A. CAROLINAS. *Michaux*. Herbarium Richard (PC; isotype: PC!).

UNITED STATES. ALABAMA. Baldwin Co.—Morgan, *Iltis 25441* (UNC, UC). Butler Co.— Mckenzie, *Henry 5725* (PH). Covington Co.—McRae, *Hen-*

ry 3331 (PH). Escambia Co.— Lindsey, *Gaines 294* (GA, NY). Houston Co.— Cottonwood, *Kral 31322* (VDB). Mobile Co.—Theodore, *Kral 28313* (VDB).

ARKANSAS. Arkansas Co.—Gillette, *Demaree 21058* (GH, MO, NY, SMU, UC). Clay Co.—Corning, *Letterman*, 10 Sep. 1883 (MO). Drew Co.—Wilmar, *Demaree 24714* (SMU). Garland Co.—*Ashe*, 22 May 1931 (UNC). Hempsted Co.— Fulton, *Letterman*, 7 May 1884 (GH). Hot Springs Co.—Malvern, *Demaree 14784* (SMU). Lafayette Co.—Lewisville, *Fisher* (SMU). Miller Co.— Doddidge, *Demaree 40817* (FSU, SMU). Mississippi Co.—Osceola, *Demaree 4265* (MO). Nevada Co.—Bluff City, *Demaree 48150* (UNC, VDB), *Demaree 60084* (VDB). Prairie Co.—Hagen, *Demaree 67808* (VDB), *57627* (VDB). Sevier Co.—Altis, *Brinkley 237* (F, TEX).

FLORIDA. Baker Co.—McClenny, *Lighthipe*, Apr 1899 (TEX). Bradford Co.—Lawtry, *Murrill*, 24 Apr 1940 (DUKE, MO). Charlotte Co.—Punte Gorda, *Small*, 27 Apr 1923 (DUKE). Clay Co.—Cove Springs, *Rau*, 21 Mar 1884 (PH). DeSota Co.—Arcadia, *Oosting 182* (DUKE). Duval Co.—Jacksonville, *Curtiss 1768* (F, GH, GA, MO, NY). Escambia Co.—Perdido R., *Ripley 10121* (NY). Franklyn Co.—Apalachicola R., *Sargent*, 15 Mar 1891 (GH). Gadsden Co.—Midway, *Godfrey 61920* (FSU, SMU, UNC, UC, VDB). Gulf Co.—Wewahitchka, *Henry 1505* (PH). Holmes Co.—Bonifay, *Leeds 2422* (PH). Jackson Co.—Cottondale, *Harbison*, 29 May 1916 (GH). Jefferson Co.—Waukeenah, *Eyles 8262* (GA). Leon Co.— Tallahassee, *Kral 6382* (GH, UC, USL, VDB). Manta Co.—Miacca, *Smith*, 4 Mar 1904 (PH). Manatee Co.— *Webb*, 1887 (F). Okaloosa Co.—Baker, *Henry 3752* (PH). Santa Rosa Co.—Milton, *McDaniel 4868* (FSU, VDB). Sarasota Co.—Osprey, *Smith 914-271* (DUKE). St. Johns Co.—St. Johns R., *Curtiss 1768* (GA, F, PH, UC). Wakulla Co.— *Ashe*, 28 Jul 1928 (UNC). Walton Co.—Seagrove Beach, *Schuster A-7324* (DUKE, VDB).

GEORGIA. Brooks Co.—Quitman, *Pyron 2179* (GA). Bullock Co.—Statesboro, *Bailey 80* (GH). Irwin Co.—Irwin, *Plummer 182* (GA). Liberty Co.— Taylor Creek, *Duncan 2231* (GA). Randolph Co.—Cuthbert, *Henry 1891* (PH). Tattnall Co.—Glennville, *Padget 230* (GA). Thomas Co.—Coolidge, *Godfrey 69463* (FSU, UNC). Tombs Co.—Lyons, *Plummer 162* (GA). Ware Co.— Waycross, *Williamson*, Apr 1897 (PH). Wayne Co.—Jessup, *Harvey*, 9 May 1940 (GA). Worth Co.—Sylvester, *Thorne 6330* (GA).

LOUISIANA. Allen Par.—Kinder, *Thieret 18712* (LAF). Caddo Par.—Vivian, *Thieret 27606* (LAF). Caldwell Par.—Columbia, *Thieret 20780* (LAF). Natchitoches Par.—*Harbison*, 5 Jul 1930 (UNC). Orleans Par.—Lake Pontchartrain, *Small*, 21 Apr 1928 (NY). Ouachita Par.—Lake Cheniere, *Kral 8862* (FSU, LAF, UNC). Rapides Par.—Alexandria, *Hale* (F, PH). Sabine Par.— Many, *Demaree 47369* (UNC); Toro, *Demaree 48234* (UNC). Tangipahoa Par. —Hammond, *Cooley 4176* (GA). Union Par.—Farmerville, *Henry 6429 (PH)*.

MISSISSIPPI. Franklin Co.—*Eggert*, 6 May 1893 (UNC). Jackson Co.— Ocean Springs, *Earle*, 29 Apr 1889 (NY), *Skehan 99* (DUKE, GH, F, MO, TEX, UNC, SMU).

MISSOURI. Butler Co.—Neelyville, *Steyermark 26616* (F).

SOUTH CAROLINA. Berkeley Co.—Wando, *Duncan 5989* (GA). Williams-

burg Co.—Greeleyville, *Radford 21313* (UNC).

TEXAS. Angelina Co.—Nacogdoches, *Cory 26001* (GH). Cass Co.—Cass, *Gentry 3478* (UNC). Gregg Co.—*York*, 24 Jul 1939 (GH). Hardin Co.—Silsbee, *Palmer 9578* (GH, MO). Harrison Co.—Taylors Island, *Whitehouse 30348* (SMU). Jefferson Co.—Beaumont, *Reverchon 3869* (GH, MO). Marion Co.—Smithland, *Correll 38479* (UNC). Nacogdoches Co.—Nacogdoches, *Waller 179* (TEX). Newton Co.—Deweyville, *Whitehouse 30143* (SMU). Orange Co.—*Letterman*, Aug 1880 (MO). Polk Co.—*Tharp*, 15 May 1942 (TEX). Tyler Co.—Chester, *Tharp 54773* (SMU, TEX). Upshur Co.—Ore City, *Correll 13181* (NY, SMU).

This taxon was first described by Michaux (1803) and was given the rank of species. It was later lowered to the rank of forma by Perkins (1907) and then raised to varietal rank by Rehder (1917). In this treatment I am following Rehder's designation because I believe that the characters separating it from var. *americana* are not sufficient to justify recognizing it as a species. As mentioned previously, intermediates difficult if not impossible to identify do occur, but the identity of the variety and the species remains distinct.

Variety *pulverulenta,* being densely scurfy hairy, is often confused with *S. grandifolia.* The leaves of the latter species are obovate and usually quite large, but sometimes on high dry sites, they are much smaller and are barely if at all obovate, being more ovate. It is this form of *S. grandifolia* with which var. *pulverulenta* is confused and then only when flowering or fruiting material is not available.

2. *STYRAX GRANDIFOLIA* Aiton, Hort. Kew. 2:75. 1789.

Styrax officinalis sensu Walt., Fl. Carol. 140. 1788 (non L., 1753).

Styrax cavaleriei Lév., Repert. Spec. Nov. Regni Veg. 4:331. 1907.

Styrax touchanensis Lév., op. cit. 11:64. 1912.

Broad shrub to small tree, to 9 m high, the branching somewhat flabellate but forming a roundish crown. Leaf blades obovate, oval-elliptic, 4–20 cm long, margins distantly toothed or entire, the bases cuneately narrowed or rounded, apices acute to short acuminate; upper surfaces glabrous, varying from pale to dark green; lower surfaces densely to finely tomentose, pale; petioles 4–9 mm long, pubescent. Flowers solitary, or more often in loose, axillary, drooping, 5–20 flowered racemes, 5–15 cm long, subtended by small bracts; calices 4–5 mm long, canescent, teeth small, acute; corolla lobes 15–22 mm long, elliptic, soft downy pubescent, apices acute to rounded; stamens as long as corolla lobes; filaments densely pilose at base to 1/3 their length; anthers 1/3 the length of the stamens; style about 2 mm longer than the stamens; stigma 3-lobed. Drupes subglobose, 7–9 mm in diameter, lightly tomentose, portion of the style persistent as an apiculation; seeds 1–2, globose or obovoid, dark brown, dull (Fig. 4).

Styrax grandifolia occupies a variety of sites from low woods to higher well-drained sandy soils, upon which it is probably more prevalent. It ranges throughout the southeastern United States from Virginia to southern Florida, westward through Louisiana (although it is scarce in the coastal marshes,

occurring there only on raised ridges such as salt domes, etc.), and into eastern Texas, then northward to southeastern Missouri (Fig. 17).

The flowers appear with the leaves from March through April. The colloquial name is "Big leaf snow-bell."

Holotype: U.S.A. *Hort. Fothergill,* 1779 (BM; photograph of holotype examined. A representative specimen of *S. grandifolia,* sent to BM, was found to represent the same species as the holotype).

UNITED STATES. ALABAMA. Cherokee Co.—Little River, *Kral 33355* (VDB). Choctaw Co.—Nanafalia, *Gonsoulin 1029* (NY, PH, SMU, US, VDB). Cullman Co.—St. Bernard, *Germann,* 12 May 1930 (GH, F, NY, UC). Franklin Co.—Bear Creek, *Kral 26448* (VDB). Marengo Co.—Magnolia, *Clark 13770* (UNC).

ARKANSAS. Conway Co.—Morrilton, *Demaree 45521* (SMU, VDB). Hot Springs Co.—Malvern, *Demaree 56562* (SMU, VDB). Madison Co.—Brashers, *Gonsoulin 1010* (NY, PH, SMU, US, VDB). Pulaski Co.—Pinnade, *Demaree 8882* (GH, NY, SMU). Saline Co.— Paron, *Demaree 59891* (VDB).

FLORIDA. Calhoun Co.—Altha, *Godfrey 52702* (FSU, UNC, VDB). Duval Co.—Jacksonville, *Curtis 6357* (MO, NY, SMU, UC). Jackson Co.—Chipola R., *Godfrey 57722* (GH, FSU). Taylor Co.—Athena, *Gonsoulin 1229* (NY, PH, SMU, US, VDB). Walton Co.—Eucheena, *Godfrey 62684* (FSU, SMU, UNC, VDB).

GEORGIA. Bartow Co.—Allatoona R., *Duncan 8095* (GA, MO). Ben Hill Co.— Abbeville, *Wilbur 3067* (FSU, GA). Bullock Co.—Statesboro, *Ahles 1145* (GH, SMU). Colquitt Co.—Ellenton, *Gonsoulin 1234* (NY, PH, SMU, US, VDB). Early Co.—Hilton, *Thorne 5356* (F, GH, NY). Lee Co.—Starksville, *Duncan 2324* (GA, UNC).

KENTUCKY. Clay Co.—Spurlock, *Gonsoulin 1204* (NY, PH, SMU, US, VDB). Harrison Co.—Cynthiana, *Gonsoulin 1206* (NY, PH, SMU, US, VDB).

LOUISIANA. Acadia Par.—Eunice, *Gonsoulin 1003* (NY, PH, SMU, US, VDB). Avoyelles Par.—Ringgold, *Ewan 18985* (GA, GH, MO). Catahoula Par. —Harrisonburg, *Thieret 28749* (FSU). Lincoln Par.—Vienna, *Thieret 24534* (LAF, UNC). Ouachita Par.—Monroe, *Kral 8532* (FSU, GH, SMU).

MISSISSIPPI. Clarke Co.—Quitman, *Jones 12058 (GA, FSU).* Forest Co.— Hattisburg, *Harbison 15743* (GH, UNC). George Co.—Lucedale, *Gonsoulin 1016* (NY, PH, SMU, US, VDB). Lauderdale Co.—Mt. Barton, *Jones 7037* (GA, FSU, UNC). Tallahatchie Co.—Charleston, *Hardin 15420* (GA).

MISSOURI. New Madrid Co.—La Forge, *Steyermark 69683* (F).

NORTH CAROLINA. Bladen Co.—Elizabethtown, *Ahles 23495* (GA, NY, *UNC,* VDB). Craven Co.—Fort Barnwell, *Totten,* 27 May 1958 (UNC). Guilford Co.—Deep River, *Melvin,* 20 Sep 1953 (UNC). Lee Co.—Moncure, *Radford 6272* (GH, UNC). Stanly Co.—Yadkin R., *Palmer 39989* (GH, MO).

SOUTH CAROLINA. Abbeyville Co.—Abbeville, *Radford 22816* (FSU,. UNC). Beauford Co.—Beauford, *Millichamp 1883* (F, NY, UNC). Chesterfield Co.—McBee, *Gonsoulin 1121* (NY, PH, SMU, US, VDB). McCormick Co.— McCormick, *Duncan 10989* (GA, MO). Oconee Co.—Walhalla, *Huger,* May

1895 (NY, PH, SMU, US, VDB).

TENNESSEE. Cumberland Co.— Linary, *Gonsoulin 1116* (NY, PH, SMU, US, VDB). Decatur Co.—Sugartree, *Sharp 12916* (DUKE, FSU, GA, GH, MO, NY, SMU, UNC). Hickman Co.—Vernon, *Shanks 5854* (GA). Marion Co.—Gizzard Cove, *Ramseur 1133A* (UNC). Wayne Co.—Waynesboro, *Kral 31681* (VDB).

TEXAS. Angelina Co.—Zavalla, *Gonsoulin 1007* (NY, PH, SMU, US, VDB). Hardin Co.—Silsbee, *Cory 52764* (NY, SMU). Jasper Co.—Jasper, *Correll 27425* (UNC), *Correll 29106*. Newton Co.—Newton, *Cory 52647* (SMU). Sabine Co.—Hemphill, *Quarterman 58-80* (VDB). Tyler Co.—Woodville, *Kral 29119* (VDB).

VIRGINIA. Bath Co.—Clifton, *Gonsoulin 1129* (NY, PH, SMU, US, VDB). Nansemond Co.—Suffolk, *Bartram*, 17 Sep 1907 (PH).

This species is well marked. Within its range there is no species of *Styrax* with which it can be confused. Earliest records of *S. grandifolia* appear in Walter's *Flora Caroliniana* (1788). Walter referred to the material he studied as *S. officinalis* L. Aiton (1789) corrected this misidentification by applying the name *S. grandifolia* Ait. The original description given by Aiton is rather brief, but the geographic area occupied by this species does not allow for error.

There seems to be much variation in this species, which may explain why Walter thought he was dealing with *S. officinalis* instead of a new species.

The leaves of *S. officinalis*, both of the Mediterranean species and of the two Californian varieties, are broadly elliptic to nearly orbicular and are 4–8 cm long, in comparison with those of *S. grandifolia*, which are generally obovate and are 6–20 cm long. The lower surface of the leaf of the former varies from glabrous to fulvescent, depending on the variety.

However, many times when *S. grandifolia* is growing on high, well-drained, sandy soils, the mature leaves are 4–8 cm long (unusually small) and are often nearly orbicular shape as in *S. officinalis*. Although the flowers of *S. officinalis* are larger than those of *S. grandifolia*, a mistake in identity could easily be made.

Styrax grandifolia shares its geographic range with another well-marked species, *S. americana*, but the two rarely overlap in their ecological ranges, because *S. americana* occupies lower moister sites.

3. *STYRAX PLATANIFOLIA* Engelmann

Key to Varieties

1a. Leaves essentially glabrous; pedicels glabrous or nearly so; calices glabrous or covered with a light matted pubescence; distribution centering about Llano County, Texas (Fig. 5). . . 3a. *S. platanifolia* var. *platanifolia*

1b. Leaves bearing scattered coarse stellate trichomes; pedicels and calices covered with a dense fine indumentum; distribution centering around Bandera and Kendall Counties, Texas (Fig. 5).
. . . 3b. *S. platanifolia* var. *stellata*

3a. *STYRAX PLATANIFOLIA* Engelmann var. *PLATANIFOLIA*, Boston J. Nat. Hist. 6:146-147. 1854.

Shrub to 4 m with freely branched, open, irregular crown and rather slender branchlets. Leaves glabrous, suborbicular, blades 3–8 cm long, margins entire, undulate, or angulate toothed, the bases broadly subcordate or truncate, apices acute to obtuse; upper surfaces light to dark green, semilustrous; lower surfaces paler; veins finely reticulate on both surfaces; petioles slender, 3–13 mm long, glabrous or very faintly pubescent. Flowers in axillary, semi-drooping, 3–5 flowered racemes, 3.5–7 cm long, subtended by minute bracts; pedicels 6–10 mm long, slightly pubescent; calices 4–6 mm long, semiglabrous, campanulate, truncate, shallowly toothed, teeth acute; corolla lobes 12–14 mm long, oblong to elliptic or ovate, apex obtuse to acute, surface with soft downy pubescence; stamens just shorter than corolla lobes; filaments flattened, pubescent near base; style exserted, slightly longer than the stamens, pubescent ½ way to apex; stigma barely 3-lobed. Drupes subglobose or ovate, 8–10 mm in diameter, style persistent as an apiculation; seeds 1–2, oval to ovate, rounded at the apex and base with a ridge running from the hilum sideward (Fig. 5).

Styrax platanifolia occurs in rather dry, wooded bottomlands and on rocky banks and ledges in central Texas in the Edwards Plateau region (Fig. 18).

The flowers appear with the leaves from early March through April. The colloquial name is "Sycamore-leaf snow-bell."

Holotype: U.S.A. TEXAS. Comal Co.: Near New Braunfels. *Lindheimer*, Mar 1852 (MO!).

UNITED STATES. TEXAS. Blanco Co.—Twin Sisters, *Gonsoulin 1289* (NY, PH, SMU, US, VDB); Fishers Store, *Parks S.N.* (SMU, TEX); Little Blanco R., *Parks*, 24 Aug 1947 (SMU); Blanco, *Henry 6523* (PH), *Wilson T-41* (F). Burnet Co.—Bertram, *Tharp*, 16 Jun 1950 (TEX), *Carsner* (SMU); Smithwick, *Henry 6557* (PH). Caldwell Co.—Delhi, *Gonsoulin 1287* (NY, PH, SMU, US, VDB). Comal Co. New Braunfels *Lindheimer*, Mar 1852 (GH). Edwards Co.—Rocksprings, *Gonsoulin 1306* (NY, PH, SMU, US, VDB). Gillespie Co.—Enchanted Rock, *Jermy 105* (F, MO). Hays Co.—Cedar Park, *Gonsoulin 1288* (NY, PH, SMU, US, VDB); San Marcos, *Stanfield 1897* (NY). Kerr Co.—Hunt, *Gonsoulin 1305* (NY, PH, SMU, US, VDB). Kimble Co.—*Palmer 10709* (GH, MO); Big Jaline Creek, *Reverchon*, May 1885 (GH), *Coleman*, 18 May 1960 (TEX). Kendall Co.—Boerne, *Palmer 9843* (MO, PH); Curry Creek, *Correll 29152* (UNC); Kendalia, *Correll 29572* (UNC); Spanish Pass, *Clemens*, 5 Jul 1911 (F). Kinney Co.—Laguna, *Gonsoulin 1307* (NY, PH, SMU, US, VDB). Llano Co.—Enchanted Rock, *Whitehouse*, 12 Jun 1930 (GH, MO, NY, UNC), *C.C.A.* (TEX). Real Co.—Leakey, *Gonsoulin 1307* (NY, PH, SMU, US, VDB). Travis Co.— Cow Creek, *Correll 37003* (FSU, UNC); Austin, *Whitehouse*, 3 May 1930 (GH, MO, SMU), *Prowse*, 3 May 1930 (TEX), *Huppertz*, Apr 1913 (TEX), *Wright* (GH); Bull Creek, *Young*, 19 Apr 1910 (MO, TEX).

Styrax platanifolia var. *platanifolia* occurs in the Edwards Plateau region of Texas. The upper or western edge of the Coastal Plain lies at an elevation

of about 600 ft., and the escarpment of the Edwards Plateau to the west rises to an average elevation of 2,700 ft. The various drainage courses descend from the plateau to the Coastal Plain through canyons. *Styrax* occurs only on the escarpment and in the canyons.

Styrax platanifolia var. *platanifolia* is described as having the foliage, pedicels, and calices glabrous or nearly so. This characterization is accurate for specimens from the northern and eastern portions of the range. However, in the southern and southwestern portions it grades into var. *stellata*, the intermediates having varying amounts of pubescence. Both var. *platanifolia* and var. *stellata* grow on highly calcareous soils and at elevations of a few hundred feet or lower.

There seems to be no confusion in the earlier literature as to the identity of this species. *Styrax platanifolia* was the only *Styrax* reported in central Texas and none was known from western Texas. However, Cory (1943) described a new variety, *S. platanifolia* var. *stellata*, and two new species, *S. texana*, whose range overlaps that of *S. platanifolia*, and *S. youngae*, from the Davis Mountains in western Texas. He summarized the differences among the three species of western Texas *Styrax* as follows:

S. platanifolia	*S. texana*	*S. youngae*
Upper leaf surface dull green, glabrous to bearing scattered stellate trichomes; reticulate veiny.	Upper leaf surface bright green, glabrous, not reticulate veiny.	Upper surface dull green, densely and coarsely stellate pubescent, not reticulate veiny.
Lower and upper leaf surfaces similar.	Lower surfaces markedly dissimilar to upper, lower bright silvery with a fine and dense indumentum only.	Lower dissimilar to upper but not markedly so; grayish tomentose with a fine and dense indumentum beset with coarse stellate hairs.
Pedicel glabrous or nearly so.	Pedicel pubescent.	Pedicel densely coarsely stellate pubescent.
Calyx dark brown, glabrous to finely puberulent; apex glandular and prominently toothed.	Calyx pale, densely puberulent; apex glandular and prominently toothed.	Calyx dark brown, densely stellate pubescent; apex non-glandular, the teeth inconspicuous.
Style pubescent half-way to apex.	Style pubescent only at base.	Style pubescent nearly to apex.

Styrax platanifolia is easily distinguished from *S. texana* and *S. youngae* by its larger more reticulate-veiny leaves. The glandular, prominently-toothed calices of *S. texana* are reliable in separating it from *S. youngae,* which has non-glandular inconspicuous teeth. The above chart together with ecological information should make identification quite easy.

My collections of *S. platanifolia* in 1969 added several new counties to its known range. All the plants of these collections were growing on rocky ledges, slopes, or other well-drained areas.

3b. *STYRAX PLATANIFOLIA* Engelmann var. *STELLATA* Cory, Madroño 7(4): 111-112. 1943.

Upper surfaces of the leaves dull green with scattered stellate trichomes; lower surfaces pale, covered with coarse stellate trichomes. Veins numerous and finely reticulate on both surfaces; petiole slender, 8–13 mm long, very faintly pubescent. Pedicels 6–10 mm long, covered with a dense fine indumentum; calices 4–6 mm long, covered with a dense fine indumentum (Fig. 5).

Styrax platanifolia var. *stellata* occurs in the Edwards Plateau region of Texas centering in Bandera and Kendall counties, extending into Bexar and Guadalupe counties. Through its range it occurs on the same type wooded bottomlands, rocky banks, and ledges as var. *platanifolia* (Fig. 18).

The flowers appear from early March through April. The colloquial name is "Hairy sycamore-leaf snow-bell."

Holotype: U.S.A. TEXAS. Bandera Co.: 6.5 miles north of Vanderpool, *Cory*, 16 Jun 1940 (TEX! isotypes: F! NY!).

UNITED STATES. TEXAS. Bandera Co.—Vanderpool, *Cory,* 15 Jun 1940 (GH), *Cory 49452* (SMU), *Cory 34764* (F, TEX, NY), *Henry 6539* (SMU), *Palmer 11528* (MO, NY), *Parks 1009* (GH), *Parks 40990* (GH, TEX); west of Boerne, *Johnson 599* (TEX); Seco Creek, *Palmer 10237* (GH). Bexar Co. —Leon Springs, *Cappell T316* (FSU). Guadalupe Co.— Cibolo, *Schattenbert,* 15 Jun 1913 (GH). Kendall Co.—Boerne, *Hastings,* 1911 (GH), *Palmer 9843* (GH); Cebolo Creek, *Palmer 11474* (GH, MO, NY); Spanish Pass, *Clemens,* 5 Jul 1911 (MO, TEX).

4. *STYRAX TEXANA* Cory, Madroño 7(4): 112-113. 1943.

Spreading shrub, 1.5–4 m high, with slender irregular branches. Leaves oval to broadly elliptic, blades 4–8 cm long, about as broad, margins entire or subentire, the bases truncate or rounded, apices abruptly acute or blunt-pointed; upper surface bright green, smooth, glabrous; lower surfaces conspicuously white with dense indumentum, veins prominent; petioles 8–15 mm long, green to reddish, grooved above, with scattered trichomes. Flowers axillary, solitary, or in 2–5 flowered racemes, 12–20 mm long, subtended by minute bracts; pedicels 10–12 mm long, puberulent; calices 4–6 mm long, pale, densely puberulent, apex glandular and 5–7 toothed; corolla lobes 14–18 mm long, elliptic to oblong, puberulent, apex obtuse to acute; stamens as long as corolla lobes; filaments flattened, pubescent near the base; style stout at the base, pubescent only at the base, often exceeding the length of

the corolla lobes; stigma slightly lobed. Drupes maturing August–September, globose to subglobose, 7–8 mm in diameter, style barely persistent as a small apiculation; seeds 1–2, globose, smooth, often with one or two shallow grooves on the sides (Fig. 6).

Styrax texana is confined to central Texas where it usually grows in inaccessible places on steep limestone cliffs, generally at elevations just below 2,000 ft. The type locality is Edwards County. In addition, it occurs in Bexar and Real counties (Fig. 18).

The flowers appear with the leaves in mid-April. The colloquial name is "Texas snow-bell."

Holotype: U.S.A. *TEXAS*. Edwards Co.: Polecat Canyon. *Cory*, 19 Apr 1942 (GH! isotypes: GH! NY!).

UNITED STATES. TEXAS. Bexar Co.—Nueces Canyon, *Cory 42659* (F), *Cory 42678* (F). Edwards Co.—Polecat Creek, *Cory 34940* (GH), *Cory 34936* (SMU, TEX), *Cory 38939* (GH, NY), *Cory 38935* (TEX), *Cory 49178* (SMU); Cedar Creek, *Cory 37767* (TEX), *Cory 38763* (TEX); Little Hackberry Creek, *Cory 42955* (SMU, TEX), *Cory 42953* (NY). Real Co.—Nueces River, *Cory 42677* (NY, TEX), *Cory 42661* (NY), *Cory 42664* (NY), *Cory 42873* (GH), *Cory 42668* (GH).

This species occurs with *S. platanifolia* and its var. *stellata* in the southwestern part of their range. The foliage of *S. platanifolia* is usually of larger dull green leaves with a coarse texture, being distinctly reticulate veiny, and undulate or angulate toothed. The foliage of *S. texana* is much finer in texture, with the upper leaf surface dark green in contrast to the lower surface, which is bright silvery with a very dense, fine, silky, pubescence; neither surface is distinctly reticulate veiny.

The calyx and pedicel of *S. texana* are densely puberulent while those of *S. platanifolia* are glabrous or nearly so, as in var. *stellata*. The apex of the calyx in *S. texana* is glandular and is prominently toothed, two characters which help to distinguish it from *S. youngae*, also of southwestern Texas (see discussion under *S. platanifolia* for character comparisons).

5. *STYRAX YOUNGAE* Cory, Madroño 7(4): 113-115. 1943.

Shrub, 2.5–3 m high. Leaves orbicular to elliptical, blades 2.5–5 cm long, to 3.5 cm broad, margins entire or subentire, bases more or less rounded, apices acute; upper surface dark green, with coarse stellate hairs, not reticulate veiny; lower surfaces tomentose, but not silvery, with very fine and dense indumentum of coarse stellate hairs, veins prominent, straw colored; petiole 5–6 mm long, tomentose. Flowers in axillary, 3–7 flowered racemes, 4–20 mm long, coarsely stellate pubescent; pedicels stout, 4–8 mm long, densely and coarsely stellate pubescent; calices 4–5 mm long and broad, dark brown, densely stellate pubescent, apex truncate, non-glandular, teeth inconspicuous; corolla lobes 12–15 mm long, narrowly elliptic, obtuse, densely stellate puberulent; style stout, 16–17 mm long, stellate pubescent to near the apex; stigma barely lobed. Drupes globose, 8–10 mm in diameter; seed 1, subglobose, smooth (Fig. 6).

Until now, the type collection, from a canyon in the Davis Mountains, Texas, was the only one available for this species. However, two unidentified collections of *Styrax* I examined during my study turned out to be *S. youngae*. These were from Coahuila and Nuevo León, Mexico, thus extending the known range of this species (Fig. 18).

The flowers appear from April through May. The colloquial name is "Young's snow-bell."

Holotype: U.S.A. *TEXAS*. Davis Mountains, canyon. *Young*, 12 May 1914 (TEX!).

MEXICO. COAHUILA. Rancho Auga Dulci, *Wynd & Mueller 340* (GH, MO, NY).

NUEVO LEON. Monterrey, *Smith M149* (TEX).

UNITED STATES. TEXAS. Davis Mts., *Young*, 12 May 1914 (TEX); Limpia Canyon, *Young 23* (MO).

The type collection of *S. youngae* is the only collection of *Styrax* from the mountains of southwestern Texas. The exact type locality is unknown but Cory (1943) states "it is likely some minor canyon for the larger ones are named and were known even more than 30 years ago." The species is named after its discoverer, a pioneer botanist in exploration of the mountains of southwestern Texas.

Styrax youngae grows in soils developed on igneous rocks and in which free limestone is absent, at elevations in excess of 4,000 ft. *Styrax texana* grows at elevations just below 2,000 ft. Cory states:

> It seems probable that *Styrax youngae* is a species of northern Mexico, for at this point in far western Texas there are mountains on both sides of the Rio Grande. Inasmuch as the plant has not been found in the 29 intervening years since its original collection, this species must be rare and at its northern limit in the Davis Mountains of southwestern Texas. It is known that *Styrax* has disappeared from localities where once it was not uncommon, and it seems true that at the present time, it grows in places inaccessible to the Angora goat, or in places where this animal is not grazed. The circumstantial evidence is that the foliage of *Styrax* is palatable as a browse to these hardy animals that produce our mohair.

Three other collections of *S. youngae* are hereby recorded. Two collected in 1936 in Coahuila, Mexico *(Wynd & Mueller 340,* GH, MO, NY) were, if seen by Cory, not detected as being *S. youngae*. The other collection was made in 1960 in Nuevo León, Mexico *(Smith M149,* TEX). These collections confirm Cory's suspicions that *S. youngae* is indeed a species of northern Mexico. These specimens have slightly more dense pubescence on the undersurface of the leaves and on the calices and pedicels than does the holotype, but other characteristics fit the species so that identification is certain. All of these collections were made at higher elevations (4,000–4,500 ft.).

6. *STYRAX OFFICINALIS* Linnaeus.

Key to Varieties

Leaf blades broadly ovate to slightly orbicular, glabrous or with scattered stellate trichomes below; calices faintly pubescent; range centers in north central California (Fig. 7). . . . 6a. *S. officinalis* var. *californica*
Leaf blades usually suborbicular, sometimes ovate-orbicular, heavily fulvescent pubescent below; calices tomentose with general prevalence of rufous hairs; rang centers in southern California (Fig. 7). . . . . 6b. *S. officinalis* var. *fulvescens*

6a. *STYRAX OFFICINALIS* Linnaeus var. *CALIFORNICA* (Torrey) Rehder, Mitt. Deutsch. Dendrol. Ges. 1915: 226. 1915.

Styrax californica Torr., Smithsonian Contrib. 6(IV): 1-8, t. 12. 1853.

Styrax officinalis L. var. *californica* (Torr.) Munz and Johnson, Bull. Torrey Bot. Club 51:297. 1924.

Shrub to 3 m, upright, branching, with irregular crown. Leaves glabrous to lightly pubescent below, blades broadly ovate to slightly orbicular, 4–6 cm long, margins entire, bases obtuse to rounded, apices acute to obtuse; upper surfaces light green, smooth; lower surfaces paler, often with very fine scattered stellate trichomes; veins slightly impressed; petioles 5–8 mm long, slender, glabrous or very faintly pubescent. Flowers in terminal or axillary, 3–5 flowered racemes, borne on short leafy branches; calices 5–7 mm long, faintly pubescent, shallowly toothed, teeth acute; corolla lobes 12–15 mm long, oblong to obovate, apices acute, surfaces with soft downy pubescence along the borders fading inward; stamens about 2 mm shorter than corolla lobes; filaments pubescent throughout their length; anthers 1/3 the length of the stamens; style barely exceeding the corolla lobes, pubescent on the proximal ½; stigma barely lobed. Drupes maturing August–September, globose, 8–10 mm in diameter, style persistent as an apiculation; seeds subglobose, shining, smooth, longitudinally grooved (Fig. 7).

Styrax officinalis var. *californica* occurs generally in the foothills of the Sierra Nevadas along watercourses from 500 to 3,500 ft. elevation (Jepson, 1963). From Siskiyou County, its northernmost locality, it ranges southwestward to Lake and Alameda counties, eastward to Eldorado and Placer counties and then to Fresno County, its southern limit (Fig. 18). Jepson (1963) gives the southernmost extension as San Bernardino County, but I have not seen material from this county that I would call var. *californica*. The known range of var. *californica* was, before my study, much more restricted than presently, extending only from Shasta County south to Amador and Calaveras counties (Copeland, 1938).

The flowers appear from April through mid-May. The colloquial name is "Snowdrop bush."

Holotype: U.S.A. *CALIFORNIA*. Sacramento Co.: Upper Sacramento. *Fremont*, 1845-47 (NY!).

UNITED STATES. CALIFORNIA. Alameda Co.—*Bracelin 1235* (F, NY), *Bracelin 2586* (F, NY), Berkeley, *Kelee* (UNC). Amador Co.—Glenco, *Belshaw 2379* (UNC). Butte Co.—Enterprise, *Heller 1 1891* (F, GH, MO, NY,

UNC). Calaveras Co.—Mokelumme R., *Hanson 227* (GH, MO, NY). Colusa Co.—Clear Lake, *Hoover 4988* (UNC); Leesville, *Heller 13111* (F, GH, MO, NY, PH); Bear Valley, *Bacigalupi 3187* (NY, UNC). El Dorado Co.—*Natoma* Ditch, *Brandegee*, 14 May 1907 (PH); American River, *Smith 2540* (UNC). Fresno Co.—Mill Creek, *Bacigalupi 7686* (FSU). Glenn Co.—Neesville, *Heller 11535* (F, GH, MO, NY, PH, UNC). Lake Co.—Leesville, *Abrams 12577* (NY); Sulphur Banks, *Eastwood 5640* (F, GH); Williams, *Clausen 1027* (UNC); Clear Lake, *Carter 353* (UNC); Borax Lake, *Simontacchi 264* (UNC); Soda Bay, *Neuns 165* (UNC), *Schulthers*, 9 Aug 1931 (UNC), *Hastings*, 28 Apr 1940 (UNC), *Howell 15589* (GH); Bartlett Springs, *Bleedlove 5180* (DUKE, SMU); Servier Lake, *Bowmann*, 11 May 1901 (GH). Placer Co.—Auburn, *Carter 1485* (GH, NY, UNC); Auburn, *Crum 2043* (UNC); Colfax, *Hitchcock 6391* (NY); Forest Hill, *Jump*, 15 May 1939 (GH, UNC). Sacramento Co.—Upper Sacramento, *Pringle 14757* (F, GH, MO); Sacramento R., *Capt. Wilkes*, 1838 (NY), *Fremont*, 1845 (NY), *Hulse* (NY); Folsom, *Copeland 1614* (GH, UNC), *Nordstron 79* (UNC). Shasta Co.—Redding, *Johannsen 149* (NY), *Johannsen 122* (UNC), *Hitchcock 6486* (MO, UNC), *McVaugh 6238* (UNC), *Grant 7976* (UNC), *Balls 20724* (NY); Kennett, *Eastwood 1455* (GH), *Smith 168* (GH); Lemoine, *Eastwood 1804* (GH), *Rose 34238* (F, NY, SMU); Pitt R., *Mason 5876* (GH, UNC), *Heller 13498* (F, MO, NY), *Jones*, 16 Jul 1931 (MO), *Brown 273* (F, NY, UNC); Delta, *Jepson 6177* (NY); Whiskey Town, *Howell 29185* (NY), *Rose 54029* (NY); Trinity, *Balls 18665* (NY); Tall House, *Baker*, 30 Apr 1900 (UNC); Weaverville, *Josephson 24* (UNC); Baird, *Coombs*, 9 Jul 1915 (GH). Siskiyou Co.— Pitt R., *McMinn 2493* (UNC); McCloud, *Sculphan 150* (NY). Tehama Co.— Paskenta, *Crampton 7773* (UNC). Yuba Co.—Strawberry Valley, *Burks 38* (UNC); Smartville, *Josephson 37* (UNC).

The type locality, "Upper Sacramento," means the neighborhood of the Sacramento and the Pitt rivers in what is now Shasta County.

The nomenclature of this taxon is rather confusing. Its present rank is due to its strong resemblance to *S. officinalis* of southern Europe, from which it is chiefly distinguished by its few-flowered racemes, thickened pedicels (a character that does not hold up), and longer staminal tube. After Torrey (1853) described *S. californica*, it was reduced by Perkins (1907) to synonymy under *S. officinalis* and then resurrected by Rehder (1915) and, independently, by Munz and Johnston (1924) as *S. officinalis* var. *californica.* So the distribution of *S. officinalis* is the Mediterranean region and California. The movement of this entity through the land bridges that occurred across the Bering Sea is quite possible, as many species of animals and plants are known to have accomplished this. Several species of *Styrax* are represented in Asia. Some of them resemble *S. officinalis*. Among these are *S. macranthus* Perk. of central Asia, *S. japonicus* Sieb. and Zucc. of Japan, *S. obassia* Sieb. and Zucc. of China and Japan, and *S. odoratissimus* Champ. of China. The last species occupies the northernmost range of those mentioned. Perhaps elements of *S. officinalis* moved northwestward during interglacial periods, eventually crossing the Bering Sea land bridge. As the climate cooled

once again, the glaciers returned, destroying the species over much of the former range by forcing it south into terrain not suitable for it. Little is known of the fossil record of *Styrax*, especially in the region concerned.

The California material differs from the Mediterranean material in the characters mentioned and in pubescence, being glabrate or lightly tomentose on the underside of the leaves instead of closely white tomentose. This pubescence is dimorphic along the veins and midrib, with dark colored trichomes being scattered among and projecting above the pallid mass of the tomentum. Also, the style in Mediterranean material appears to be less compressed than in California material and is evidently less lobed (Munz and Johnson, 1924).

In that only differences between the European and the Californian examples are minor, being neither constant nor significant, I agree with Munz and Johnston (1924) and Copeland (1938) and treat the Californian material as varieties of *S. officinalis*.

For information concerning the embryology of *S. officinalis* var. *californica* the reader is referred to Copeland (1938).

6b. *STYRAX OFFICINALIS* Linnaeus var. *FULVESCENS* (Eastwood) Munz and Johnston, Bull. Torrey Bot. Club 51: 295-302. 1924.

Styrax californica Torr. var. *fulvescens* Eastw., Bot. Gaz. 41: 283-296. 1906.

Leaf blades broadly ovate-orbicular to subcordate, 4–6 cm long, margins entire, bases broadly ovate to subcordate, apices obtuse or abruptly acuminate, only slightly longer than broad; upper surfaces light green, smooth to roughened, glabrous or with a few scattered stellate trichomes; lower surfaces much paler, pubescent to densely tomentose. Calices 5–7 mm long, shallowly toothed, teeth acute, usually white tomentose (Fig. 7).

According to Munz and Johnston (1924), var. *fulvescens* ranges along the coastal slopes of California from the mountains near Santa Barbara to those near San Diego. The ranges of the two varieties (var. *californica* and var. *fulvescens)* are widely separated, with Santa Barbara County the northernmost extension. The known range of var. *fulvescens* is here extended as far north as Mendocino and Butte counties (Fig. 18).

The flowers appear from mid-April through May. The colloquial name is "Hairy snowdrop bush."

Holotype: U.S.A. *CALIFORNIA*. Santa Barbara Co.: Painted Cave Ranch, Santa Barbara Mountains. *Wolf*, 17 May 1904 (GH!).

UNITED STATES. CALIFORNIA. Amador Co.—Zion, *Hansen 840* (UNC). Butte Co.— *Bidwell,* May 1879 (GH). Calaveras Co.—Mokelumme Hill, *Blaisdell* (GH); Golden Gate Hill, *Rosemary 225* (UNC); Calaveras R., *Stanford 300* (GH, MO). El Dorado Co.—Salmon Falls, *Robbins 1934* (GH, UNC). Fresno Co.—Trimmer, *Bucksloe,* 10 May 1953 (GH, UNC); Trimmer, *Clark 46-14* (GH), *Quibell 1927* (NY, UNC), *Quibell 1565* (DUKE); Kings R., *Crawford 25n* (UNC). Lake Co.—Mt. Konocti, *Blankinship,* 1 May 1924 (MO); Lower Lake, *Cuff 133* (UNC); Hough Springs, *Abrams 6273* (NY, US). Meno-

docino Co.— *Vasey*, 1870 (GH). Orange Co.—Star Canyon, *Hutt 373* (DUKE); Trabuco Canyon, *Smith 5453* (F); Corona, *Lewis 380* (UNC). Placer Co.—Folsom, *Wolf 8609* (GH, MO, NY). Riverside Co.—Temecula, *Stubblefield*, 2 May 1938 (NY); Elsinore, *Spring 34* (UNC). Sacramento Co.—Folsom, *Copeland*, 30 Apr 1939 (GH, F, MO, NY, UNC). San Bernardino Co.—Cajou Pass, *Craig 922* (GH); San Bernardino Mts., *Parish*, 29 May 1888 (UNC), *Parish*, Apr 1887 (MO), *Parish 307* (GH, MO, NY, PH, UNC), *Parish 11389* (UNC); San Bernardino, *Lemmon*, May 1878 (F); Waterman Canyon, *Jepson 551* (VDB); San Savaine, *Ewan 10982* (GH, MO); Mts., *Engelmann* 20 Sep 1880 (GH, MO); San Bernardino Mts., *Clark 15916* (SMU); Big Bear Lake, *McMinn 1560* (UNC). San Diego Co.—Rainbow, *Jensen 141* (UNC); Fall Brook, *Parry*, May 1883 (MO); Mesa Grande, *Gander 200* (UNC), *Spencer 1147* (NY); Luis Rey R., *Mason 3138* (GH, UNC); Henshaw Dam area, *Munz 10353* (GH, UNC). San Luis Co.—Nipomo, *Lee 635* (UNC). Santa Barbara Co.—Santa Inez Mts., *Wolf 2302* (UNC); Painted Cave Ranch, *Eastwood 33* (F, GH, MO, NY, UNC), *Wiggins 8508* (GH); Santa Barbara, *Brandegee*, 1888 (F); Rattlesnake Canyon, *Mason 456* (GH, UNC).

Eastwood (1906) first described this variety as *S. californica* var. *fulvescens:* "Differs from the typical *Styrax californica* in the broader, rounder leaves, cordate at base, the much denser stellate tomentum, and the general prevalence of rufous hairs especially on the calyx." Munz and Johnston (1924) created a new combination, *S. officinalis* var. *fulvescens*, which I accept for reasons previously discussed.

This variety ranges over a much greater area than originally thought. The ranges of var. *californica* and var. *fulvescens* do overlap considerably. Within this overlap are intermediate forms with various degrees of pubescence. Thus, while the two varieties are generally separated geographically, there does exist an area, which includes El Dorado, Amador, and Calaveras counties, in which intermediates occur.

7. *STYRAX JALISCANA* Watson, Proc. Amer. Acad. Arts 26:144. 1891.

Styrax officinalis L. var. *jaliscana* (Wats.) Perkins, Pflanzenreich IV. 241 (Heft 30); 82. 1907.

Shrub to 1 m, rather freely branched. Leaves subsessile, blades round-ovate or oblong-ovate, 4–10 cm long, the bases obtuse or somewhat cuneate, margins entire, apices abruptly short-acuminate; upper surfaces pale, densely white tomentose and reticulately veined; petioles 3–4 mm long, densely white tomentose. Flowers in axillary, 1–5 flowered racemes, 8–12 mm long; pedicels 4–6 mm long, densely white tomentose; calices 5–7 mm long, densely white tomentose, very evidently dentate, teeth 5–7, length 1–1.7 mm, acute; corolla lobes 12–14 mm long, oblong to elliptic-ovate, apices obtuse to acute, surface with soft downy pubescence; stamens 2–3 mm shorter than corolla lobes; filaments pubescent near the bases; style barely longer than the corolla lobes, essentially glabrous and slightly lobed. Drupes 8–12 mm in diameter, depressed-globose; seeds usually 3, smooth, with a ridge running from the hilum sideward (Fig. 8).

New branchlets densely white tomentose. Teeth evident on persistent calices.

Styrax jaliscana occurs on rocky hillsides and rather dry slopes. Although only a few collections are available, they attest to the wide range of this species, which extends from northern Baja California through southern Mexico (Fig. 19).

Holotype: *MEXICO. JALISCO.* Near Guadalajara. *Pringle 2978*, 10 Nov 1889 (GH!).

MEXICO. BAJA CALIFORNIA. Sierra Laguna, *Gentry 4420* (GH, UNC).

GUERRERO. Galeana, *Hinton 4583* (NY).

JALISCO. Near Guadalajara, *Pringle 2978* (GH), *Pringle 4416* (F, MO, NY, PH, US, UNC), *Pringle 11012* (F, MO, NY, US).

SINALOA. Sierra Surotato, *Gentry 6244* (MO, NY).

Standley (1924) states that *S. jaliscana* may not be specifically distinct from *S. officinalis*. In gross morphology it does resemble the California varieties of the latter species, especially var. *fulvescens*, but, on closer examination, differences of specific rank may be seen. The leaves of *S. jaliscana* have a slightly larger length/width ratio and are more acuminate, whereas those of *S. officinalis* tend to be more acute to very short-acuminate. Leaf pubescence in the latter species at its densest, in var. *fulvesens*, is moderate as compared to the dense woolly pubscence of *S. jaliscana*, which persists on young branchlets and racemes. The calices of both species differ not only in pubescence but also in presence of teeth, these being much more prominent in *S. jaliscana*. These two species may well be closely related but they have diverged enough to warrant separation.

Styrax jaliscana is an extremely wide-ranging species. The collections from Sinaloa and Baja California have larger leaves, up to 10–12 cm long, than do the type and other collections from Jalisco. The species is probably relatively rare because only scattered collections are available.

There are no species currently known from its range that, on morphological grounds, could have given rise to *S. jaliscana*. Therefore, I must conclude, as Standley did, that its closest relative is *S. officinalis*.

8. *STYRAX GLABRESCENS* Bentham

Key to Varieties

Leaves essentially glabrous below (may have stellate trichomes in the vein axils); calices stellate pilose with rufous or yellowish hairs (Fig. 9). . . . . 8a. *S. glabrescens* var. *glabrescens*

Leaves lightly to densely pilose below; calices minutely grayish tomentulose (Fig. 9). . . . . 8b. *S. glabrescens* var. *pilosus*

8a. *STYRAX GLABRESCENS* Bentham var. *GLABRESCENS*, Pl. Hartweg. 66. 1839.

Styrax guatemalensis J. D. Smith, Bot. Gaz. 15: 27, 28. 1890.

Small tree, 6–12 m high, spreading. Leaves essentially glabrous, ovate-

obovate to elliptic, the blades 8–14 cm long, 4–7 cm wide, the bases cuneately narrowed to nearly rounded, margins entire to distally toothed, apices short to long acuminate; upper surfaces dark green, glabrous; lower surfaces paler, glabrous or with a few scattered stellate trichomes; surfaces reticulate-veiny; petioles 6–10 mm long, lightly stellate pubescent. Flowers in axillary, semi-drooping, 4–12 flowered racemes, 2–8 cm long, tomentose; calices 5–6 mm long, tomentose, with rufous hairs, shallowly toothed, teeth acute; corolla lobes 12–16 mm long, ovate-elliptic, apices obtuse to acute, surfaces with soft down pubescence; stamens about 2 mm shorter than corolla lobes; filaments with scattered stellate trichomes; style essentially glabrous; stigma slightly lobed. Drupes globose to subglobose, 8–12 mm in diameter, covered with dense matted tomentum; style not persistent; seeds usually 1, pale brown, with slightly roughened texture, with 2–3 grooves running from the hilum sideward (Fig. 9).

New twig growth covered with light stellate pubescence. Racemes covered with pubescence grading into dense tomentum toward the calices.

Styrax glabrescens var. *glabrescens* occurs in mountainous regions along streams, on rocky slopes, and in heavy forest from southern Costa Rica through Honduras and Guatemala and into Mexico as far north as Hidalgo (Fig. 19).

Holotype: *MEXICO. VERA CRUZ.* Near Jalapa. *Linden,* Jun 1838 (K; photograph of holotype examined).

COSTA RICA. ALAJUELA. La Palma de San Ramon, *Brenes 6734* (NY), *Brenes 3986* (F, NY), *Brenes 13599* (NY), *Brenes 6079* (F, GH, NY), *Brenes 6734 (GH).*

CARTAGO. El Muneco, *Standley 3350* (US), *Standley 51137* (GH, US).

GUATEMALA. ALTA VERAPAZ. Carcha, *Standley 70316* (F); Sasis, *Smith 1690* (GH, US).

EL QUICHE. Chajul, *Sharp 4684* (F), *Sharp 4673* (F).

HUEHUETENANGO. Barillos, *Holdridge 2338* (F), *Steyermark 49738* (F).

QUEZALTENANGO. Las Nubes, *Standley 8397* (F); San Martin, *Standley 67865* (F).

SAN MARCOS. Tecutla, *Steyermark 36807* (F); Finca, *Steyermark 37378* (F).

SUCHITEPEQUEZ. El Naranjo, *Steyermark 46750* (F).

HONDURAS. COMAYAGUA. Cordillera Montecillos, *Molina 7233* (F, US); El Achote, *Yuncker 6175* (F, GH, MO).

LA PAZ. Montana Verde, *Molina 24404* (F).

MEXICO. CHIAPAS. Siltepeg, *Matuda 5102* (F); Boqueron, *Matuda 5410* (F, MO); Letrero, *Matuda 17816* (F), *Matuda 4335* (GH, MO, NY, US); Rancho Phoenix, *Purpus 10612a* (F); Fenes, *Purpus 10088* (NY); Monserrate, *Purpus 10521* (GH, UNC).

HIDALGO. Zacualtipán, *Moore 3231* (UNC), *Martinez,* Apr 1941 (GH); Honey Station, *Pringle,* 17 Jun 1908 (US); Trinidad, *Pringle 13104* (MO, F, US).

OAXACA. Montebello, *Reko 4136* (US); Cuyamecalco, *Conzatti 3480* (US); La Sole de Vega, *Carlson 2710* (F).

PUEBLA. Huauchinango, *Lundell 12631* (UNC, US); Villa Juarez, *Rzedowski 17211b* (TEX).

VERACRUZ. Jalapa, *Pringle 8129* (F, GH, MO, NY, UNC, US), *McDaniels 942* (F); Huatusco, *Purpus 1920* (UNC); Jalapa, *Galeotti 2851* (US).

Wood and Channell (1960) mention that *S. glabrescens* is a close relative of *S. grandifolia*. The latter species is a tetraploid, but no chromosome counts of the former have been made so no relationship along these lines can be established. They do, however, resemble each other in many morphological features. The leaves of both have the same texture, but those of *S. glabrescens* lack the dense matted pubescence characteristic of *S. grandifolia*. Leaf shape differs somewhat, being broadly elliptic in the former and obovate in the latter species. The flowers are slightly larger in *S. glabrescens* and the petals have a slight purple tint contrasting to the creamy white petals of *S. grandifolia*. A good case for their close relationship exists but cytological work would be necessary for proof.

Standley (1938) says of *S. glabrescens*, "Frequent in forest of the Pacific slope, mostly at elevations of 500-1,500 meters; region south of Cartago; region of San Ramon. Extending to Mexico. Easily recognized among Costa Rican species because of the broad, thin, almost glabrous leaves, green on the lower surface."

Styrax guatemalensis, described by Smith (1890), is treated here as a synonym of *S. glabrescens*. Smith states that it differs from the latter species by its ovate leaves, its one-half larger flowers, and its ovate petals. However, the leaves and flowers are identical to those of *S. glabrescens*.

8b. *STYRAX GLABRESCENS* Bentham var. *PILOSUS* Perkins, Pflanzenreich IV. 241 (Heft 30): 72. 1907.

Styrax pilosus (Perkins) Standl. Contr. U.S. Natl. Herb. 23:1129. 1924.

Leaves ovate to obovate-elliptic, blades 6–12 cm long, 3–6 cm broad; upper surfaces dark green, essentially glabrous; lower surfaces pale green, light to densely pilose; petioles 6–10 mm long, tomentose-pilose. Calices 4–5 mm long, stellate pilose with rufous hairs (Fig. 9).

New twig growth and racemes are stellate-pilose with rufous hairs.

Styrax glabrescens var. *pilosus* has a much more restricted range than var. *glabrescens*. It occurs in mountainous regions along streams, on rocky slopes, and in heavy forest in Chiapas, Oaxaco, Veracruz, and Hidalgo (Fig. 19).

Holotype: *MEXICO. OAXACA*. Chinantla and Rincon. *Galeotti 2852*, May 1844 (NY!).

MEXICO. CHIAPAS. Escuintla, *Matuda 15995* (F), *Matuda 4179* (GH, MO, NY, US); LaConcordia, *Matuda 15922* (F); Monserrate, *Purpus 9280* (UNC, US); Fenix, *Purpus 10545* (GH, UNC); Jitotol, *Breedlove 10188* (NY).

HIDALGO. Zacualtipán, *Martinez*, May 1940 (GH).

OAXACA. *Galeotti 2852* (NY, US); Chinantla, *Galeotti 3852* (F).

VERACRUZ. Chiconquiaco, *Pompa 793* (GH).

Only a few collections of this variety have been made since it was described by Perkins (1907). Standley (1924) raised this variety to specific rank. Since the only differences between the species and its variety are relatively minor ones I am herein following Perkins' designation of this taxon as var. *pilosus*.

9. *STYRAX ARGENTEUS* Presl

Key to Varieties

Leaves covered beneath with a minute, very close, stellate tomentum (Fig. 11c). . . . . 9a. *S. argenteus* var. *ramirezii*

Leaves covered below with coarse spreading stellate hairs, the pubescence velutinous.

Leaves less than half as wide as long; racemes and new branchlets covered with very short stellate pubescence beset with lepidote trichomes (Figs. 10 & 11). . . . . 9b. *S. argenteus* var. *argenteus*

Leaves half or more as wide as long; racemes and new branchlets covered with coarse, long, spreading velutinous pubescence. (Figs. 10 & 11). . . . . 9c. *S. argenteus* var. *hintonii*

9a. *STYRAX ARGENTEUS* Presl var. *ARGENTEUS*, Rel. Haenk. II. 60. 1836.

Strigilia argentea Miers, Contrib. Bot. I:185. 1851-1861.

Styrax punctatum Smith, Enum. Pl. Guatemal. 4:104. 1895.

Styrax myristicifolius Perkins, Bot. Jahrb. Syst. 31:481. 1902.

Small tree, 6–11 m high, rather freely branched. Leaf blades oblong-elliptic, 7–14 cm long, 2.5–4.5 cm broad, margins entire, the bases cuneate to rounded or obtuse, apices short acuminate; upper surfaces glabrous, darker green, smooth to slightly coriaceous; lower surfaces paler, covered with medium length, semi-spreading stellate trichomes, the pubescence slightly velutinous, petioles 2–2.5 cm long. Flowers in axillary or terminal, semi-drooping, 6–12 flowered racemes, 6–9 cm long; pedicels 6–8 mm long, short velutinous stellate pubescent, with minute bracts basally and midway its length; calices 4–5 mm long, minutely toothed, covered with short stellate pubescence mixed with lepidote trichomes; corolla lobes 8–10 mm long, oblong-linear, acute, covered outwardly with very short, fine, soft pubescence; stamens barely shorter than corolla lobes; filaments with spreading stellate trichomes, with tufts of long trichomes basally; anthers about ½ the length of the stamens; style glabrous, about as long as stamens; stigma slightly lobed. Drupes 10–13 mm in length, 6–8 mm in diameter, oblong-elliptic, lepidote trichomiferous; seeds 1, 10–11 mm long, glossy brown, with a ridge running from the hilum sideward (Figs. 10 & 11).

New branchlets, racemes, and petioles slightly velutinous, covered with soft, short hairs.

Styrax argenteus var. *argenteus* occurs along wooded slopes throughout much of western Mexico and Central America. It extends from Sinaloa,

Mexico to Cocle, Panama, being especially prevalent in southern Mexico and Guatemala (Fig. 20).

Holotype: *MEXICO. Haenke 148* (MO!).

COSTA RICA. ALAJUELA. Zarcero, *Smith*, 12 Aug 1937 (F).

GUANACASTE. Liberia, *Williams 25087* (F); La Cruz, *Jimenez 345* (F).

HEREDIA. Heredia, *Williams 16067* (F, GH).

SAN JOSE. Finca Tablera, *Jimenez 3511* (NY).

EL SALVADOR. CHALATENANGO. La Palma, *Allen 7314* (F).

SANTA ANA. Cerro Verde, *Allen 6853* (F, US).

GUATEMALA. ALTA VERAPAZ. Tactic, *Standley 92631* (F).

BAJA VERAPAZ. El Ranchio, *Kellerman 7642* (F, NY, US).

CHIMALTENANGO. San Martin, *Standley 57958* (F); Morales R., *Martin 1208* (F).

CHIQUIMULA. La Laguna, *Steyermark 30728* (F); San Jose, *Steyermark 31150* (F).

EL PROGRESO. Finca Piamonte, *Steyermark 43593* (F).

EL QUICHE. Aguilar 1395 (F).

GUATEMALA. Barrauea, *Smith 2266* (F, GH, US); Sanarate, *Kellerman 6415* (F).

HUEHUETENANGO. San Juan, *Standley 83018* (F); San Sebastian, *Steyermark 50429* (F), *Standley 82830* (F, MO, US); San Juan, *Standley 81378* (F); Aguacatan, *Skutch 1935* (F, GH, NY, US); Carrizal, *Steyermark 50776* (F, US); Libertad, *Steyermark 51100* (F); Selegua, *Molina 21341* (F, NY).

JALAPA. El Rancho, *Kellerman 5664* (US); Jumay, *Steyermark 32340* (F, US); Monjas, *Standley 77656* (F).

ZACAPA. Rio Sitio Nuevo, *Steyermark 43199* (F); Reforma, *Steyermark 42075* (F, NY).

HONDURAS. CHOLUTECA. San Marcos, *Standley 15947* (F), *Standley 15875* (F).

COMAYAGUA. Comayagua, *Standley 5686* (F); Siquatipeque, *Standley 6344* (F), *Yuncker 5589* (F, GH, MO, US); San Antonio, *Williams 12314* (F, US).

MORAZAN. Jicarito, *Williams 14028* (F, GH); Chaquite, *Williams 12136* (GH, F, MO); Rio Capa Rosa, *Williams 12707* (F, GH); Zamorano, *Rodriguez 3669* (F, UNC), *Standley 1674* (F), *Molina 20321* (F, NY); Chahite, *Standley 5007* (F).

MEXICO. CHIAPAS. Tenejapa, *Breedlove 6366* (F, FSU), *7619* (F), *6439* (F); Jitotol, *Breedlove 8917* (F); Trinitaria, *Breedlove 14085* (F); Pass de Cura, *Bosse 8222* (F); Ocosingo, *Shilom 3431* (F); Escuintla, *Matuda 16256* (MO); Monserrate, *Purpus 46* (US); Rancho Fenin, *Purpus 14301* (GH); San Vincente, *C. Goldman 872* (US).

GUERRERO. Carnotla, *Rzedowski 18529* (TEX).

JALISCO. San Sebastian, *Mexia 1351* (F, GH, MO, NY, UNC, US), *Mexia 1861* (UNC, US).

MICHOACAN. Coahuayula, *Emrick 60* (F); Morelia, *Arsene 2841* (US).

OAXACA. Santa Ana, *Conzatti 4558* (NY, US); Concordia, *Rexo 3642* (US).

SINALOA. Suratato, *Standley 5164* (GH, NY, UNC); San Juan, *Ortega 4118* (US); San Ignacio, *Montes 714* (US); Cerro Colardo, *Henry 5164* (F, MO).

MEXICO. Villareda, *Hinton 7410* (GH, MO, US); Luvianos, *Hinton 5309* (F, GH), *Hinton 6193* (NY, US).

NICARAGUA. MATAGALPA. Jinotega, *Williams 23955* (F, NY, US); Sebaco, *Webster 12496* (F, GH).

PANAMA. CHIRIQUI. Boquete, *Stern 2045* (MO); El Volcán, *Tyron 826* (FSU).

COCLE. Ola, *Pittier 5076* (GH, NY, US).

The nomenclature of *S. argenteus* has been greatly confused since Presl (1836) first described this taxon. Eleven species since described I place in synonomy with *S. argenteus*. *Styrax hintonii* and *S. ramirezii* are treated as varieties of *S. argenteus* because they represent the extremes of variation exhibited by this species.

When Greenman (1899) described *S. ramirezii,* he evidently did not realize the entire array of variation in the *argenteus* complex. Therefore, it was reasonable for him to assume he had a new species. From 1902–1906 Perkins described seven new species. She was a definite "splitter," for although she examined a fairly wide array of material, she insisted on segregating new taxa on mostly minor and inconsistent characters. I have examined the type specimens of the seven species; the reduction of these species to synonymy is justified.

Standley (1924) recognized *S. ramirezii, S. cyathocalyx* Perkins, and *S. polyneurus* Perkins. However, on specimens in the U.S. National Herbarium, I noticed that his annotations since 1924 indicate he later considered them all *S. argenteus*. The characters he used to separate these three taxa from *S. argenteus* are those that Perkins later used, namely, pubescence on the lower side of the leaf, flower length, and calyx length. These characters are very inconsistent and were used by Perkins to separate the five other new taxa she described from the *argenteus* complex. In short, Perkins took the variations found in the complex and described new species with total disregard for the continuum of variation.

In this treatment I have placed in synonymy with *S. argenteus* most of the species that Perkins segregated from the *argenteus* complex. A cytological study is in order for this complex and until such is done the relationships among the taxa will not be established definitely.

The following chart indicates the differences between the species and its varieties:

var. *argenteus*	var. *hintonii*	var. *ramirezii*
Leaves less than half as broad as long; covered below with short spreading stellate trichomes.	Leaves half or more as broad as long; covered below with coarse, long, velutinous pubescence.	Leaves less than half as broad as long; covered below with dense, fine, matted, tomentum.

Racemes and new branchlets covered with short spreading stellate trichomes beset with lepidote scales.	Racemes and new branchlets covered with coarse, long, spreading velutinous pubescence.	Racemes and new branchlets covered with dense, fine, matted tomentum beset with lepidote scales.

9b. *STYRAX ARGENTEUS* Presl var. **hintonii** (Bullock) Gonsoulin, comb. nov.

Styrax hintonii Bullock, Kew Bull. 1936, :366-368. 1936.

Styrax magnus Lundell, Bull. Torrey Bot. Club 66:600. 1939.

Styrax vulcanicola Standl. and Steyerm., Field Mus. Publ. Bot. 22:264. 1940.

Small tree, 3–10 m high, the crown spreading. Leaf blades oblong-elliptic, 9–12 cm long, 4–7 cm wide (with extremes up to 20 cm long and 10–11 cm wide), margins entire, the bases rounded or obtuse, apices short acuminate to rounded; upper surfaces glabrous, dark green, smooth to coriaceous; lower surfaces covered with coarse, long spreading stellate trichomes, the pubescence distinctly velutinous; petioles 2–2.5 cm long, covered with coarse, long, spreading velutinous pubescence. Flowers in 6–10 flowered racemes, 2.5–4 cm long; pedicels 6–10 mm long, covered with long, spreading, velutinous pubescence; calices 5–6 mm long. minutely toothed, teeth acute, covered with long, spreading, velutinous pubescence; corolla lobes 9–11 mm long, oblong-linear, apices acute, covered outwardly with coarse matted stellate pubescence (Figs. 10 & 11).

Styrax argenteus var. *hintonii* occurs occasionally in dry mountainous regions but more often on damp wooded slopes of lower elevations. It ranges in the western regions of Mexico from Jalisco south to and throughout Guatemala (Fig. 20).

Holotype: *MEXICO. MICHOACAN.* Calera 770 m, wet barranca. *Hinton 3798*, 19 Apr 1933 (MO! isotypes: F! GH! US!).

GUATEMALA. GUATEMALA. San Raimundo, *Standley 62879* (F, NY).

HUEHUETENANGO. Cuilo, *Steyermark 50699* (F, US).

SAN MARCOS. San Fafael, *Standley 68618* (F); Tecutla, *Steyermark 36801* (F); San Rafael, *Steyermark 36234* (F).

QUEZALTENANGO. San Martin, *Standley 85557* (F).

MEXICO. CHIAPAS. Ghiesbreght 62081 (GH, MO).

GUERRERO. Yesceros, *Hinton 14404* (GH), *Hinton 14409* (US).

JALISCO. Autlan, *McVaugh 10304* (NY, TEX); San Sebastian, *Mexia 1504* (F, GH, MO, NY, US, UNC).

MICHOACAN. Morelia, *Arsene 5366* (GH, MO, US), *Arsene 8472* (MO, US), *Arsene 2841* (GH, MO, NY); Zitacuaro, *Rzedowski 18371* (TEX); Calera, *Hinton 3798* (F, GH, MO, US), *Hinton 7605* (F, GH, MO, PH, TEX, US); Nanchititla, *Hinton 7618* (GH, MO).

Styrax argenteus var. *hintonii* represents one end of the spectrum of variation in the *argenteus* complex. The pubescence of var. *hintonii* is velutinous,

being of very long, spreading, stellate hairs. The pubescence of var. *argenteus* is shorter. The leaf length/width ratio is greater in var. *argenteus* than in var. *hintonii*. Leaf size varies greatly as can be seen in *S. magnus* Lundell, which represents a large leaf form of var. *hintonii*. *Styrax vulcanicola* Standl. and Steyerm. represents an intermediate between var. *argenteus* and var. *hintonii* but with characters closer to the latter.

9c. *STYRAX ARGENTEUS* Presl var. **ramirezii** (Greenman) Gonsoulin, comb. nov.

Styrax ramirezii Greenm. Proc. Amer. Acad. Arts 34: 569. 1899.
Styrax micranthus Perkins, Bot. Jahrb. 31: 480. 1902.
Styrax polyanthus Perkins, Bot. Jahrb. 31: 479. 1902.
Styrax warscewiczii Perkins, Bot. Jahrb. 31: 480. 1902.
Styrax polyneurus Perkins, Bot. Gaz. 35:5. 1904.
Styrax cyathocalyx Perkins, Repert. Spec. Nov. Regni Veg. 2 (14/15): 24. 1906.
Styrax orizabensis Perkins, Repert. Spec. Nov. Regni Veg. 2(14/15): 25. 1906.

Small tree, 9–13 m high, the crown spreading. Lower surfaces of leaves paler, covered with very close minute stellate tomentum; petioles 1.5–2 cm long, covered with fine stellate tomentum mixed with scattered lepidote trichomes. Flowers in 6–12 flowered racemes, 5–7 cm long; pedicels 6–8 mm long, covered with short stellate pubescence mixed with lepidote trichomes; corolla lobes 8–10 mm long, oblong-linear, apices acute, covered outwardly with matted stellate trichomes (Figs. 10 & 11).

Styrax argenteus var. *ramirezii* occurs on rather dry wooded slopes in mountainous regions of western Mexico and Central America. It extends from Michoacán, Mexico, southward throughout Central America as far as Colón, Panama (Fig. 20).

Holotype: *MEXICO. MORELOS.* Mountain canyons above Cuerrnavaca. *Pringle 6848*, 15 May 1898 (NY! isotypes: F! GH! MO! PH! US!).

COLOMBIA. CHOCO. Juarin, *Duke 11500* (MO).

COSTA RICA. ALAJUELA. Zarcero, *Smith 2700* (F). *Smith 4232* (UNC), *Smith 113* (NY), *Smith 176* (F), *Smith 1971* (GH, UNC); Palmira, *Smith 2623* (F, MO), *Smith 4165* (F, UNC); San Miguel, *Brenes 6410* (NY); San Ramon, *Brenes 3772* (NY), *Brenes 3683* (NY), *Brenes 17008* (NY), *Brenes 3971* (NY), *Brenes 6464* (NY), *Brenes 5403* (NY).

CARTAGO. Vueltas, *Williams 16260* (F), *Williams 16131* (F); Trinidad, *Wilbur 8821* (DUKE); Cartago, *Chrysler 5590* (F); Guarco, *Madriz 9* (F, NY).

HEREDIA. Volcan Barba, *Hathaway 1258* (GH, DUKE); Barba, *Lems 5340* (F, NY).

SAN JOSE. San Francisco, *Smith 7079* (F, GH, NY, US); Rio Tores, *Smith 7447* (GH, US); Santa Maria, *Standley 42216* (US); Escasia, *Standley 32549* (US); Aserri, *Standley 41410* (GH, US); Rio Virilla, *Tondine 17924* (F); *Valerio 1378* (F); San Jose, *Little 6043* (F).

EL SALVADOR. AHUACHAPAN. Guaymango, *Calderon 1988* (GH, NY,

US); Finca Colima, *Standley 20147* (GH, NY, US).

CHALATENANGO. La Palma, *Allen 7314* (NY).

SANTA ANA. Santa Ana, *Carlson 690* (UNC, F), *Standley 20405* (GH, NY, US), *Allen 6882* (F), *Williams 13581* (GH, F).

GUATEMALA. ALTA VERAPAZ. Tactic, *Standley, 92400* (F), *Standley 91577* (F, NY), *Standley 92302* (F), *Standley 92574* (F), *Steyermark 43937* (F), *Molina 12236* (F, NY).

BAJA VERAPAZ. Chilasco, *Lamb 115* (F).

CHIMALTENANGO. Volcán de Pacaya, *Conduk 479* (MO, US).

CHIQUIMULA. Chiquimula, *Steyermark 30624* (F).

EL QUICHE. Chazul, *Sharp 4677* (F); Nebaj, *Contreras 5102* (F, US), *Aguilar 758* (F).

EL PROGRESO. Finco Piamonte, *Steyermark 43410* (F, UNC).

ESCUINTLA. Las Lajas, *Standley 64767* (F, GH).

GUATEMALA. San Francisco, *Standley 80605* (F), *Standley 80536* (F), *Standley 80684* (F), *Standley 80659* (F); Las Calderas, *Standley 58420* (F, GH); La Aurora, *Aguilar 186* (F), *Aguilar 456* (F), Finca Belen, *White 5260* (F).

HUEHUETENANGO. Barillas, *Steyermark 48488* (F); Huitz, *Steyermark 48666* (F); Soloma, *Steyermark 48441* (F, GH).

JALAPA. Buena Vista, *Steyermark 32827* (F, GH).

QUEZALTENANGO. San Geronimo, *Steyermark 33315* (F); Santa Maria, *Steyermark 33926* (F).

SACATEPEQUEZ. Antigua, *Standley 63786* (F), *Standley 63714* (F, GH, NY).

SAN MARCOS. Toma, *Steyermark 37989* (F), *Steyermark 36712* (F).

SANTA ROSA. Chiquimulilla, *Steyermark 33138* (F, GH); Las Vinas, *Heyde 6182* (F, GH, MO, NY, US).

SOLOLA. Finca Moca, *Steyermark 47924* (F), *Steyermark 47497* (F, GH).

SUCHITEPEQUEZ. Santa Clara, *Steyermark 46759* (F, GH); Las Nubes, *Steyermark 35418* (F).

HONDURAS. COMAYAGUA. San Luis, *Edwards P-290* (F, GH).

INTIBUCA. Yashee, *Molina 6522* (US).

LA PAZ. Marcala, *Molina 6460* (F, US).

MORAZAN. Yeguare, *Williams 11279 (F, GH, MO, US)*; Tamara, *Molina 24561* (F); *Molina 7524* (F); Cerro Uyuca, *Standley 8019* (F); Zamarano, *Rodriguez 2100* (F), *Rodriguez 3760* (F, GH, US), *Standley 1739* (F, UNC), *Williams 12648* (F, GH); Cuesta Grande, *Williams 13270* (F, GH, MO, UNC); Juancito, *Williams 17455* (F, GH).

EL PARAISO. Yuscaran, *Molina 627* (F); Arenar, *Williams 10491* (F, MO, PH); Danli, *Rodriguez 2004* (F).

DISTRITO CENTRAL. *Hagen 1253* (NY).

MEXICO. CHIAPAS. Mt. Pasitor, *Matuda 0467* (US); Mt. Orlando, *Matuda 0568* (US), *Matuda 16265* (MO), *Matuda 3930* (GH, MO, NY), *Matuda 2668* (GH, F, NY, UNC); Capilla *Bosse 8335* (F); Carmelo, *Juzepczuk 1598* (F);

Fenix, *Purpus 10082* (NY); Boquerron, *Purpus 7422* (GH, NY); Mouserrate, *Purpus 10555* (MO, NY, UNC), *10531* (GH); Fenix, *Purpus 10157* (UNC).

GUERRERO. Ancha, *Hinton 14750* (F, GH, MO, NY, US); Aguazarca, *Hinton 10400* (F, GH, MO, US); Galeana, *G. Hinton 14742* (F); Mina, *Mexia 9059* (F, GH, MO, NY, US).

MICHOACAN. Zitauara, *Mayer 267* (US); Tancitaro, *Nelson 6886* (GH, US); San Filipe, *Hinton 11831* (F, GH, MO, NY, PH, US); Morelia, *Rzedowski 18362* (TEX).

MORELOS. Tepoxtlan, *Pringle 9000* (F, GH, MO, US), *Pringle 8023* (F, GH, MO, NY, PH, US); Cuernavaca, *Hitchcock 7105* (GH, UNC, US); El Pargue, *Martinez,* Feb 1942 (UNC), *Rzedowski 19771* (TEX); Zempoala, *Mendoza,* 14 Jun 1964 (TEX); *Rose 7236* (GH, US) Chilacuate, *Martinez,* Feb 1942 (UNC); Cuernauca, *Pringle 6848* (F, GH, MO, NY, PH, US).

OAXACA. Oaxaca, *Liebmann 596b* (F); Cnicatlan, *Conzatti 2338* (F); La Loma, *Conzatti 3564* (US), *2450* (F), Cuyamacalco, *Smith 347* (GH); *Galeotto 1687* (NY, US).

NICARAGUA. MATAGALPA. La Fundadora, *Williams 24844* (F).

PANAMA. CHIRIQUI. Viejo Valley, *White 70* (F, GH); Camiseta, *Terry 1338* (F, GH); Boquete, *Davidson 776* (F, GH, US); Seco, *Woodson 484* (F, GH); Chiriqui, *Terry 1348* (F); Casita Alta, *Woodson 919* (F, NY); Bambita, *Allen 4851* (F, GH, NY, UNC); Gloria, *Pittier 4242* (NY, US).

Styrax argenteus var. *ramirezii* represents another end of the spectrum of variation in the *argenteus* complex. It is readily separated from var. *hintonii,* which has spreading velutinous pubescence, by its possession of close matted stellate pubescence on the lower surface of the leaf. The pubescence on the lower leaf surface of var. *argenteus,* while being shorter than var. *hintonii,* still has a spreading character and is easily separated from the matted tomentum of var. *ramirezii*. Most of the intermediates interpreted by Perkins (1907) to be new species are morphologically closer to var. *ramirezii*. This is reflected in the number of species placed in synonymy with this variety.

10. *STYRAX CONTERMINUS* Smith, Bot. Gaz. 18:5. 1893.

Small tree, to 14 m high, with open, freely branched crown. Leaves elliptic to oblong, blades 7–14 cm long, 3–4.5 cm broad, margins entire, the bases cuneately narrowed or nearly rounded, apices counterminously acuminate; upper surfaces glabrous, coriaceous, finely reticulate veined, light green; lower surfaces pale, nowhere reticulately veined, stellate scales lacerate, lepidote, silvery sprinkled with red; petioles ferruginous, 1.2–2 cm long. Flowers in axillary and terminal, 4–8 flowered racemes, 5–8 cm long; pedicels 10–14 mm long, ferruginous, minutely bracteolate at the base and the middle; calices 4–5 mm long, minutely toothed, silvery lepidote; corolla lobes 8–10 mm long, oblong to elliptic, silvery lepidote, apices acute; stamens barely shorter than the corolla lobes; filaments half-connate, twice as long as the oblong anthers, which are mixed with fimbriate scales; style slightly longer than stamens; stigma barely lobed. Drupes slightly asymet-

rical, oblong-elliptic, 12–15 mm long, 7–8 mm wide, silvery lepidote, style not persistent; seeds usually 1, oblong-elliptic, pale brown, lustrous, with several slight longitudinal grooves running from the hilum sideward (Fig. 12).

New branchlets and racemes covered with lacerate, ferruginous, lepidote scales.

Styrax conterminus occurs along wooded slopes in mountainous regions from Santa Ana, El Salvador, through Guatemala in Huehuetenango, Quiché, and Zacapa, and into Chiapas, Mexico (Fig. 19).

Holotype: *GUATEMALA. QUICHE.* San Miguel Uspantan, alt. 6,000 feet. *Smith 2915*, Apr 1892 (MO! isotypes: GH! US!).

EL SALVADOR. SANTA ANA. Monte Cristo, *Allen 7184* (F, GH, NY, US).

GUATEMALA. HUEHUETENANGO. San Juan, *Steyermark 49982* (F, GH, US); Puente, *Sharp 45104* (F).

QUICHE. San Miguel, *Smith 2915* (GH, MO, US).

ZACAPA. Volcan Gemelos, *Steyermark 43297* (F, GH, NY).

MEXICO. CHIAPAS. Naquivil, *Matuda 15507* (F); Boqueron, *Purpus 7422* (UNC).

In original description of *S. conterminus*, Smith (1893) states that there are three more species of the lepidote group [other than the four included in my study] but these three all are from South America. Of the four species of *Styrax* of the lepidote group included in my study, *S. conterminus* is the only one in Central America and Mexico. The other three, *S. ochraceus*, *S. portoricensis*, and *S. glaber*, occur in the Dominican Republic, Puerto Rico, and the British West Indies, respectively.

There are no species within the geographical range of *S. conterminus* with which it could be confused. Although *S. argenteus*, which has a wide range of variation in vegetative morphology, often resembles *S. conterminus*, it is readily distinguished from it by a lack of lepidote pubescence.

11. *STYRAX OBTUSIFOLIA* Grisebach, Cat. Pl. Cuba 167. 1866.

Shrub to small tree, 3–10 m high. Leaves oblong to obovate, blades 3–4 cm long, 1.5–1.8 cm broad, margins entire, the bases cuneately narrowed, apices rounded to acute; upper surfaces dark green, smooth, glossy; lower surfaces paler, covered with light, fine tomentum, with scattered lepidote trichomes. Flowers in axillary, semi-drooping, 2–6 flowered racemes, 13–15 mm long; pedicels 3–4 mm long, subtended basally by minute bracts; calices 2–3 mm long, teeth inconspicuous; racemes, calices, and pedicels covered with lepidote pubescence; corolla lobes 5–6 mm long, 1–1.5 mm wide, finely stellate pilose, apices acute; stamens barely shorter than the corolla lobes; filaments nearly glabrous; anthers ½ the length of the stamens, glabrous; styles short, barely surpassing calyx; stigma 3-lobed. Drupes obovoid, 10–12 mm long, 4–5 mm wide, apices obtuse to acute; style basally persistent; seeds 1–2, pale brown, lustrous (Fig. 13).

Styrax obtusifolia occurs on forested slopes in mountainous regions of Cuba, in the provinces of Pinar del Rio and Las Villas, and extends into Haiti and into the western sections of the Dominican Republic (Fig. 21).

Holotype: *CUBA. Wright 2931,* 1860-64 (NY! isotypes: MO! UC! US!).

CUBA. LAS VILLAS. Soledad, *Gonzales 477* (NY).

PINAR DEL RIO. Sierra de Rangel, *Roig 4516* (NY); Rosario Mts., *Bro. Alain 57* (GH), *Bro. Alain 6097* (GH, US), *Bro. Alain 714* (NY); La Mulata, *Bro. Alain 2440* (NY); Rio Taco-Taco, *Ekman 17633* (NY, US).

SANTA CLARA. Santa Clara, *Britton 5451* (F, NY); Trinidad Hills, *Jack 8606* (F, GH, NY, US), *Jack 8089* (NY, US), *Jack 7129* (F, GH, NY, US); San Juan, *Howard 5618* (NY, US); Lomas de Banao, *Luna 448* (NY), *Luna 40* (NY).

HAITI. NORD. Bourbon, *Ekman 1954* (F, NY, US).

DOMINICAN REPUBLIC. DAJABON. Partido, *Liogier 16242* (NY).

Perkins (1907) indicates that *S. obtusifolia* is restricted to Cuba. However, although this is the only Cuban *Styrax,* it does extend into western Dominican Republic where its range overlaps with *S. ochraceus*. Vegetative morphology of both species is quite similar, but the flowers are strikingly different. The racemes of *S. obtusifolia* are much more lax, generally having several more flowers, in contrast to the short, rather stiff racemes of *S. ochraceus* with 2–3 flowers. The flowers of the former species, 7–9 mm long, are smaller than those of the latter, 2.5–3.4 cm long. These floral characters could not possibly be confused. The fruits of both species are similar, those of *S. obtusifolia* being 1–2 mm larger, not an appreciable difference.

12. *STYRAX OCHRACEUS* Urban, *In* Symb. Ant. 7:331. 1912.

Shrub to small tree, 3–8 m high. Leaves essentially glabrous, occasionally having scattered lepidote trichomes on the lower surfaces, blades obovate to elliptic, 2.5–5 cm long, 1.5–2.5 cm broad, margins entire, the bases cuneately narrowed, apices rounded to acute, occasionally mucronate tipped; upper surfaces dark green, smooth, glossy; lower surfaces paler, glossy; petioles 5–6 mm long, rufous stellate. Flowers in axillary, 2–3 flowered racemes, 1–1.5 cm long, subtended at the bases of the calices, midway and basally on the pedicels by minute bracts; pedicels 6–8 mm long; calyx 6–8 mm long, very shallowly toothed or teeth wanting, covered with dense rufous lepidote pubescence; corolla lobes 2–2 8 cm long, 2–3 mm wide, linear, remaining partially fused for 2/3 their length, the distant 1/3 being free and reflexed, covered with rufous stellate pubescence, lobes adnate to the calyx tube near its base; stamens 2–3 mm shorter than corolla lobes; filaments glabrous, fused basally upward for 4/5 their length and adnate to the corolla lobes for ¾ their length; anthers 3–4 mm long; style as long as corolla lobes; stigma slightly lobed. Drupes oblong, 8–10 mm long, covered with crusty lepidote scales; seeds usually 1, pale yellowish-brown with three slight grooves running from the hilum sideward (Fig. 14).

Styrax ochraceus occurs in both mountainous cloud forest and heavily forested slopes into the high valleys. No collections have yet been made in eastern Dominican Republic, where the mountainous terrain gives way to rolling hills (Fig. 21).

Holotype: *DOMINICAN REPUBLIC. LA VEGA.* In Loma Rosilla. *Fuertes*

1766, Jul 1912 (PC; isotype: PC!).

DOMINICAN REPUBLIC. BAHORUCO. Sierra de Neiba, *Liogier 12506* (NY), *Jimenez 5622* (NY).

BARAHONA. Loma dela Sal, *Liogier 11364* (NY); Jarabacoa, *Liogier 11983* (NY).

LA VEGA. Loma Rosilla, *M. Fuertes 1766* (NY); La Rucille, *Liogier 12148* (NY), *Liogier 12142* (NY); Valle Nuevo, *Ekman 13883* (F, GH, NY, US); Constanza, *Liogier 16105* (NY).

SAN JUAN. La Pelona, *Liogier 12818* (NY).

Province unknown, Loma del Oro, *Liogier 11546* (NY).

Styrax obtusifolia, which occurs mainly in Cuba, does extend into Haiti and into the northwestern section of the Dominican Republic. Here it is sympatric with *S. ochraceus*, but the two species are not easily confused. The closest relative of *S. ochraceus* seems to be *S. obtusifolia* because of its adjacent range and its strong resemblance vegetatively, but the flowers are so different as to suggest some other lineage.

Although no collections of *S. ochraceus* have been made from Haiti, much terrain there is mountainous, providing suitable habitats for its growth. No doubt it will be found in Haiti as well.

13. *STYRAX PORTORICENSIS* Krug and Urban, Bot. Jarhb. Syst. 15: 337-338. 1893.

Small tree, 10–20 m high, spreading crown. Leaves essentially glabrous, occasionally having distant stellate trichomes on the lower surfaces, blades elliptic, 6–12 cm long, 3–5 cm broad, margins entire, the bases cuneately narrowed, apices acute to short acuminate; upper surfaces dark green, glossy; lower surfaces paler; finely reticulate on both surfaces, petioles 6–12 mm long with scattered lepidote trichomes. Flowers in axillary or terminal, semi-drooping, 3–6 flowered racemes, 2–5 cm long, pedicels 10–15 mm long, ferruginous, lepidote, minutely bracteolate at the base; calices 4–5 mm long, minutely toothed, ferruginous, lepidote; corolla lobes 12–15 mm long, oblong-elliptic, acute, with silvery lepidote pubescence; styles just shorter than corolla lobes; filaments about as long as anthers, both mixed with scattered, long, stellate trichomes, bases of filaments with tufts of long trichomes; style glabrous, about as long as corolla lobes; stigma 3-lobed. Drupes slightly asymetrical, oblong-elliptic, 2.5–3.5 cm long, 13–15 cm wide, apices slightly acuminate, covered with crusty lepidote trichomes; seeds 18–22 mm long, 8–10 mm wide, pale reddish brown, faintly glossy, with three pale grooves running from the hilum sideward (Fig. 15).

The racemes and new branchlets are covered with lacerate, ferruginous, lepidote trichomes.

Styrax portoricensis, endemic to Puerto Rico and the only *Styrax* occurring there, is found on slopes along creeks and in mountainous regions. In the original description, Krug and Urban (1893) give the habitat in Puerto Rico as "in Sierra Juncos, de Naguabo et de Luquillo, in sylvis Primaevis, veris. Sept. Florif." (Fig. 21).

Holotype: *PUERTO RICO. HUMACAO.* Sierra de Naguabo in montis Piedra pelada. *Urban 1169*, 26 Apr 1885 (NY! isotypes: F! GH! MO! US!).

PUERTO RICO. HUMACAO. Sierra de Yabucoa, *Urban 2661* (NY, US); Sierra de Naguabo, *Urban 1169* (F, GH, MO, NY, US). Province unknown, *Horu 309* (NY).

Styrax portoricensis is very distinct and not readily confused with any other *Styrax* included in this study. The leaves, thickened and with revolute margins, very much resemble those of *Quercus virginiana* of the southeastern United States. The flowers resemble those of *S. argenteus* in general morphology but have dense lepidote pubescence. The fruit are very distinct, by far the largest of any *Styrax* included herein.

14. *STYRAX GLABER* Swartz, Nov. Gen. et Spec. Plant. 74. 1788.

Styrax occidentalis Sw. ex Thunb. Diss. de Styrace. 8. 1813.

Small to medium sized tree, 6–18 m tall. Leaves elliptical or elliptical-oblong, blades 8–15 cm long, 3.5–5.5 cm broad, margins subentire, the bases cuneate, apices short to long acuminate; upper surfaces glabrous, smooth to slightly coriaceous; lower surfaces covered with pale lepidote-stellate pubescence; petioles 12–14 mm long, lepidote-stellate. Flowers in axillary, semi-drooping, 4–7 flowered racemes, 2.5–3.5 cm long; pedicels 9–14 mm long, lepidote-stellate, with minute bracts basally; calices 5–6 mm long, truncate, minutely toothed, lepidote-stellate; corolla lobes 16–18 mm long, oblong-linear, acute, covered with matted lepidote-stellate pubescence; stamens 3 mm shorter than corolla lobes, anthers 2/5 this length; filaments bearded basally with long trichomes, glabrous upwards; style glabrous, barely longer than the stamens; stigma 3-lobed. Drupes ovoid to globose-ovoid, 2 cm long, 1 cm wide, style basally persistent; seeds usually 1, smooth, pale brown (Fig. 16).

Styrax glaber occurs on moist slopes throughout the Windward Islands, ranging through Guadeloupe, Martinique, Saint Lucia, and Tobago. It is also recorded from Trinidad (Fig. 21).

Holotype: *BRITISH WEST INDIES. Willdenow 8326* (B; photograph of holotype examined).

WEST INDIES. GUADELOUPE. Bois de Bains-Tames, *Pere Duss 3263* (F, NY, US).

MARTINIQUE. Herbier de la Martinique, *Pere Duss 1900* (US); *1728* (F, MO, NY, US).

ST. LUCIA. Barre de L'Ile, *Beard 510* (MO, NY, UNC); Barre de L'Ile, *Beard 1113* (GH, MO, NY).

TOBAGO. Orxborough, *Cowan 1413* (NY).

Styrax glaber is the only *Styrax* occurring in the British West Indies. Perkins (1902) described a new variety, *S. glaber* var. *micranthus*, from Trinidad. It is, of course, possible that it is a "good" taxon and that it may intergrade with material from South America. Urban (1892) mentions the range of *S. glaber* (var. *glaber*) to include Trinidad. Since Perkins was a notorious "splitter" and since I have not seen the type material or any oth-

er specimen of var. *micranthus*, it is not recognized in this study.

Grisebach (1864) lists *S. guianensis*, found in Guiana and equatorial Brazil, as a synonym of *S. glaber*. This may be the entity that Perkins calls var. *micranthus*. In any event, further study of South American *Styrax* is necessary to establish the relationship between these taxa and *S. glaber* of the British West Indies.

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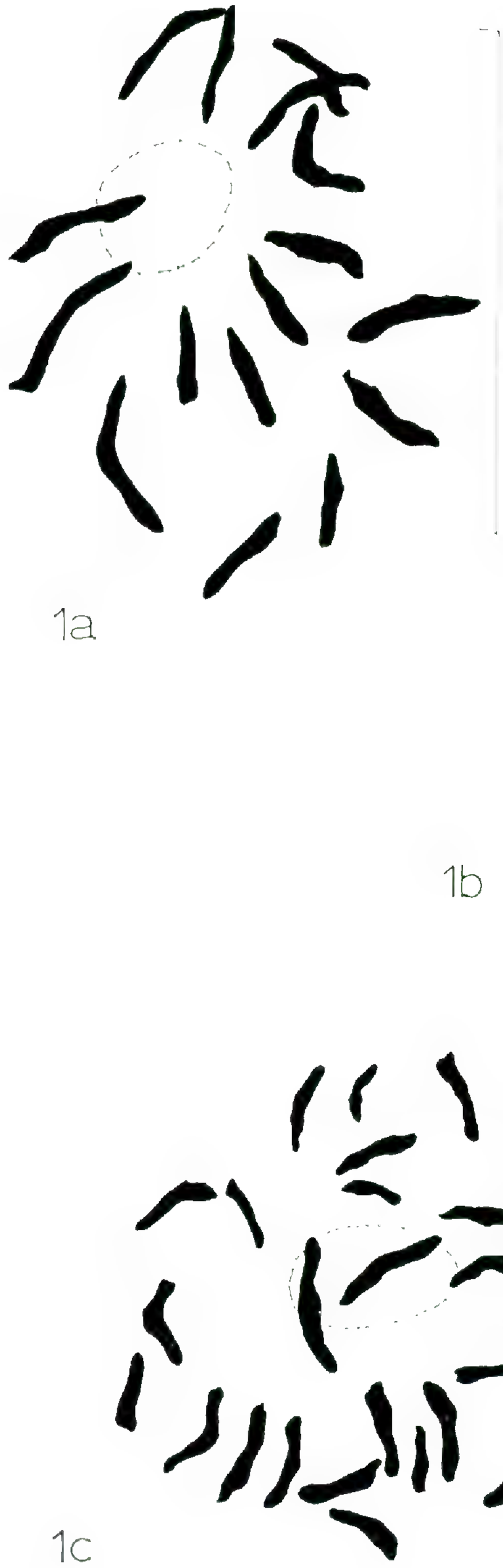
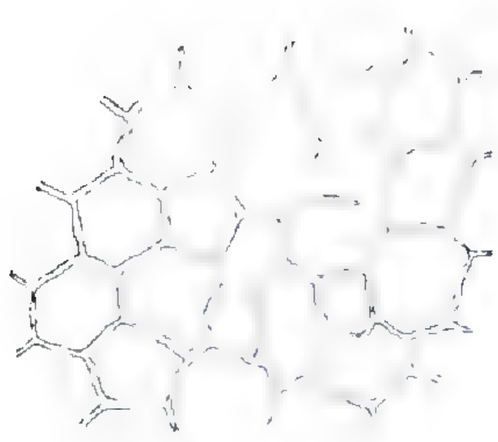


Fig. 1. Early prophase I in pollen mother cells: a. *Styrax americana* var. *americana;* b. *S americana* var. *pulverulenta;* c. *S. grandifolia.*

2a



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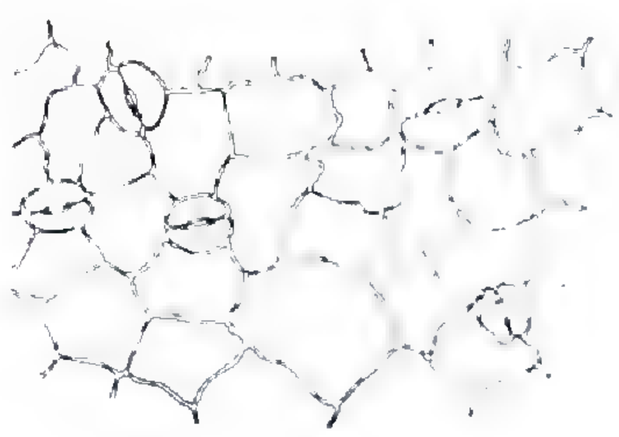

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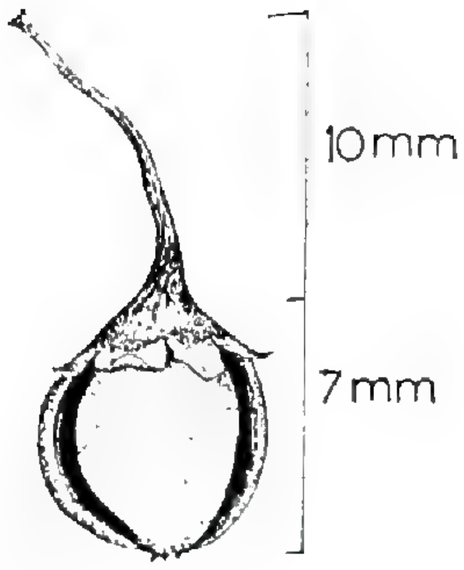

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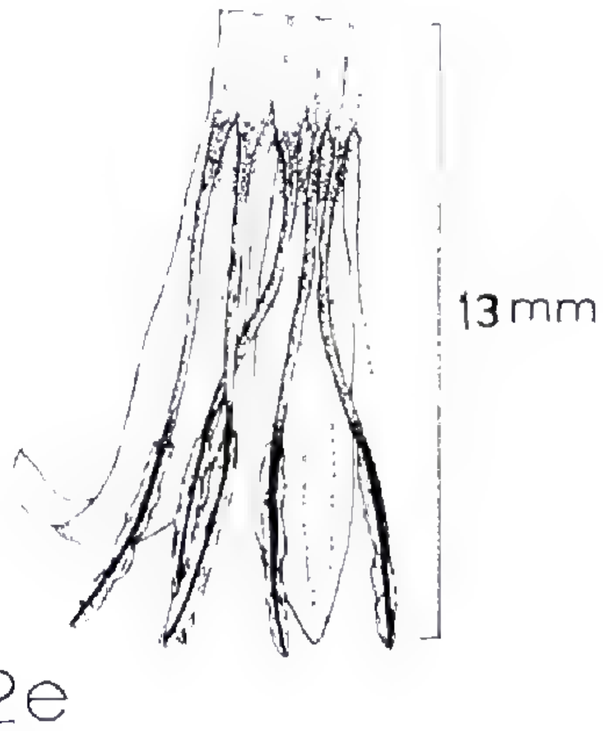
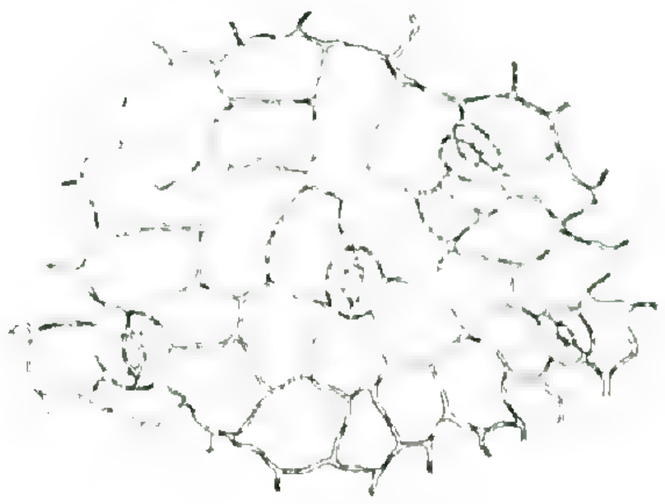


2e

Fig. 2. *Styrax americana* var. *americana:* a. habit sketch; b, c. upper & lower leaf epidermis (500×); d, e. mature flower parts; f. mature fruit.

3a

3b



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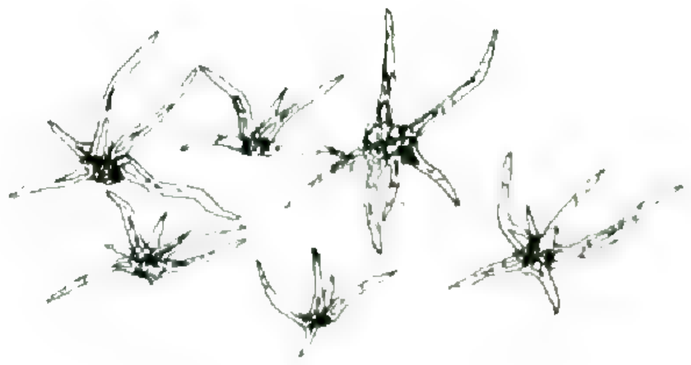

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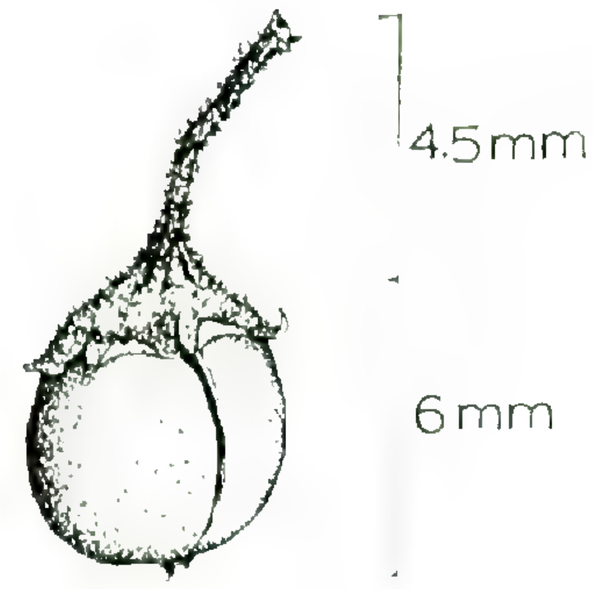

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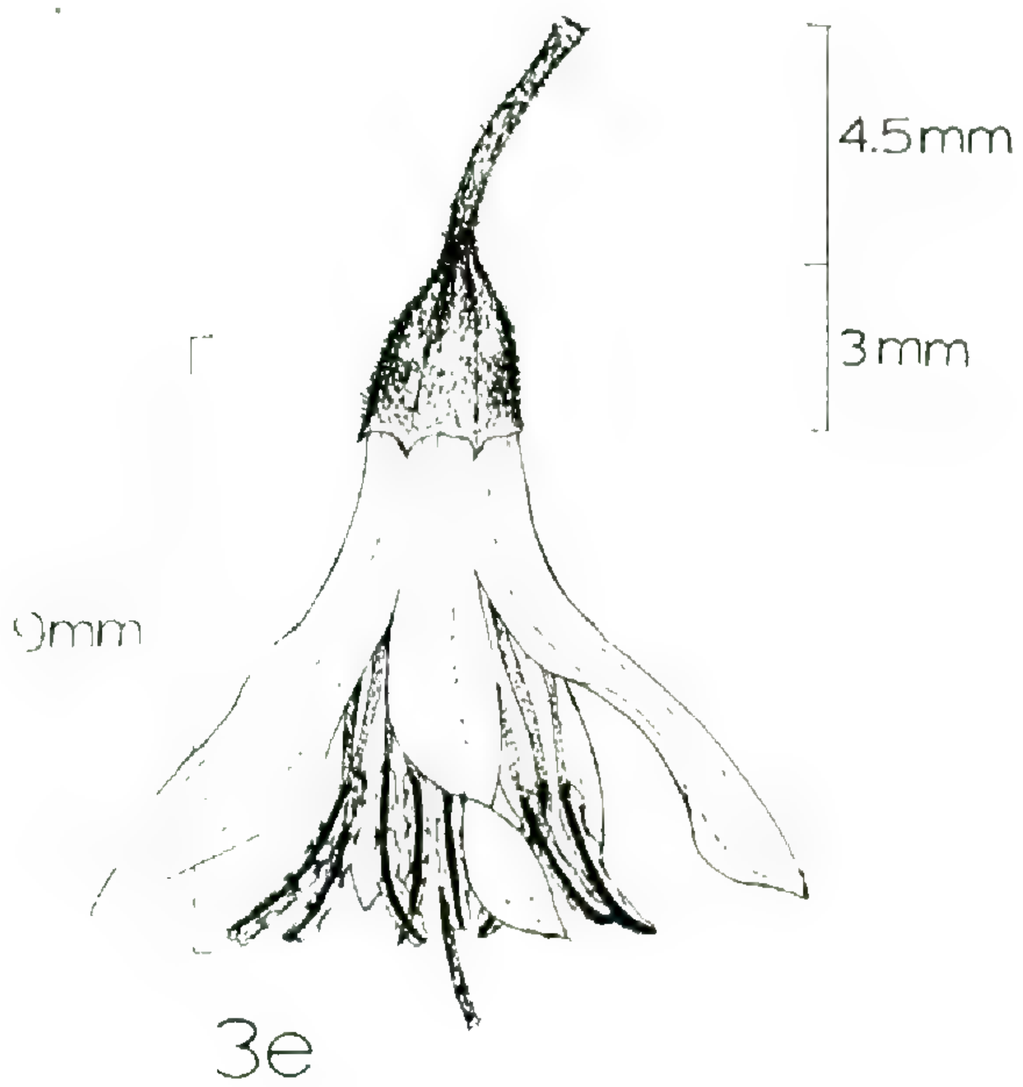

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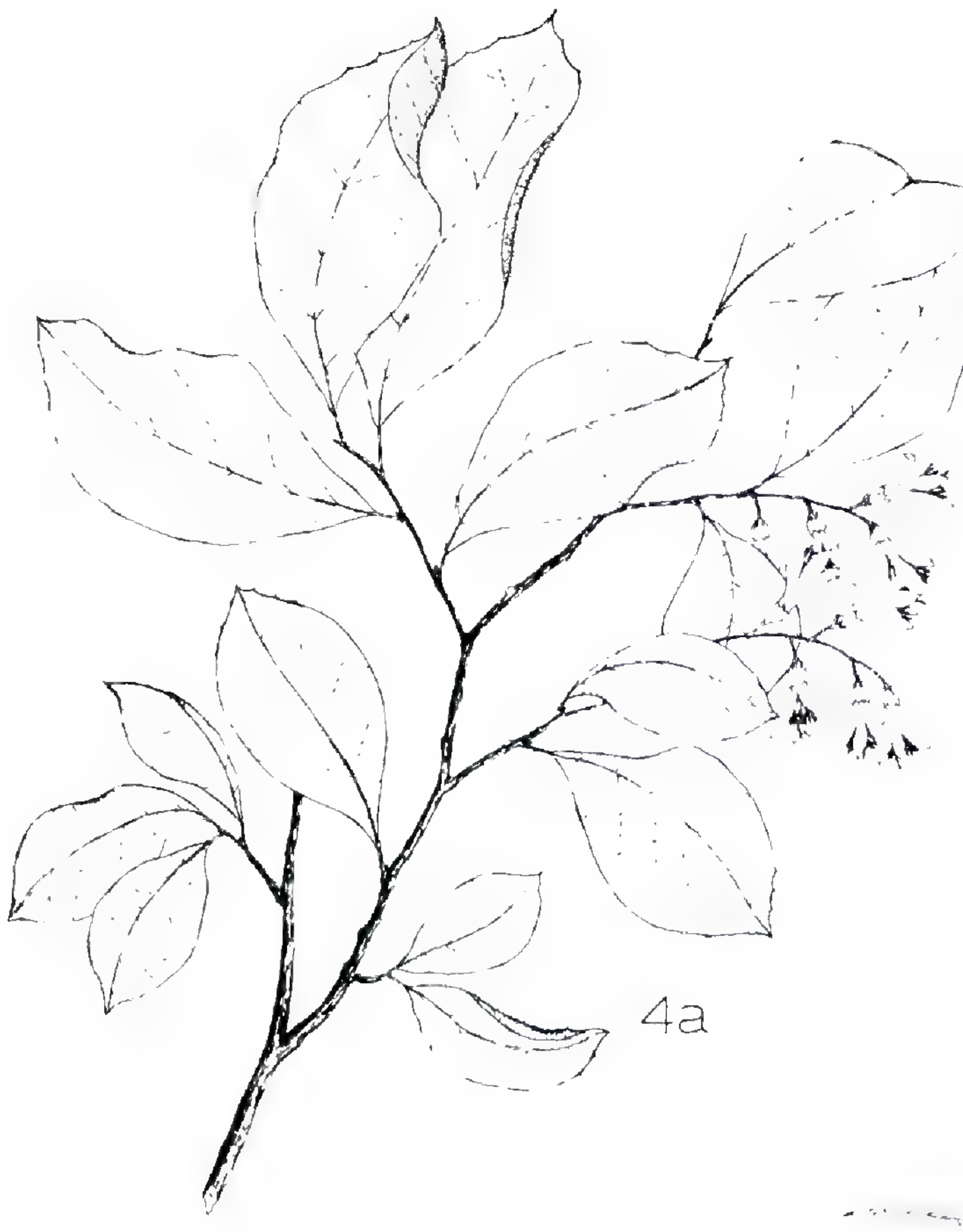
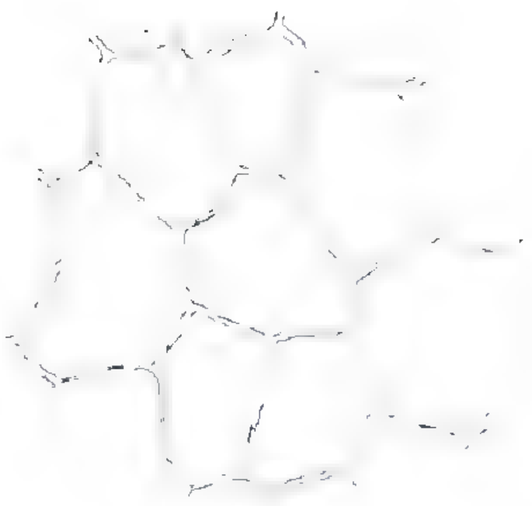
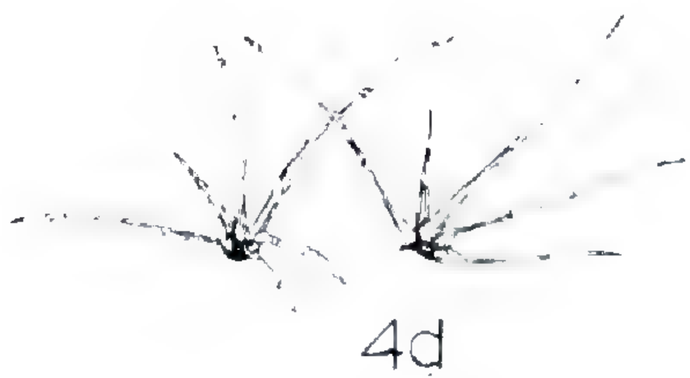
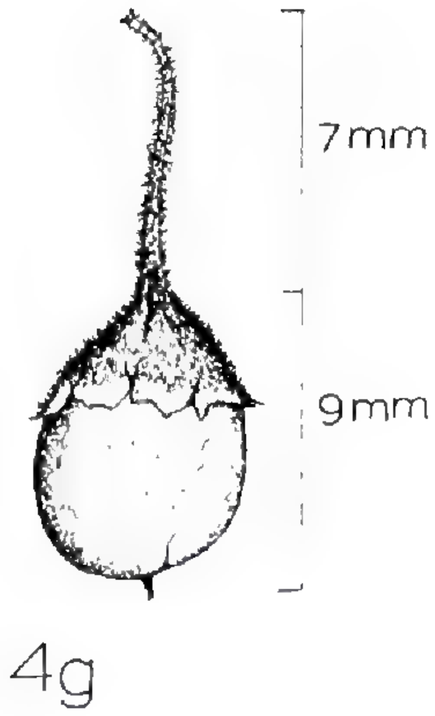








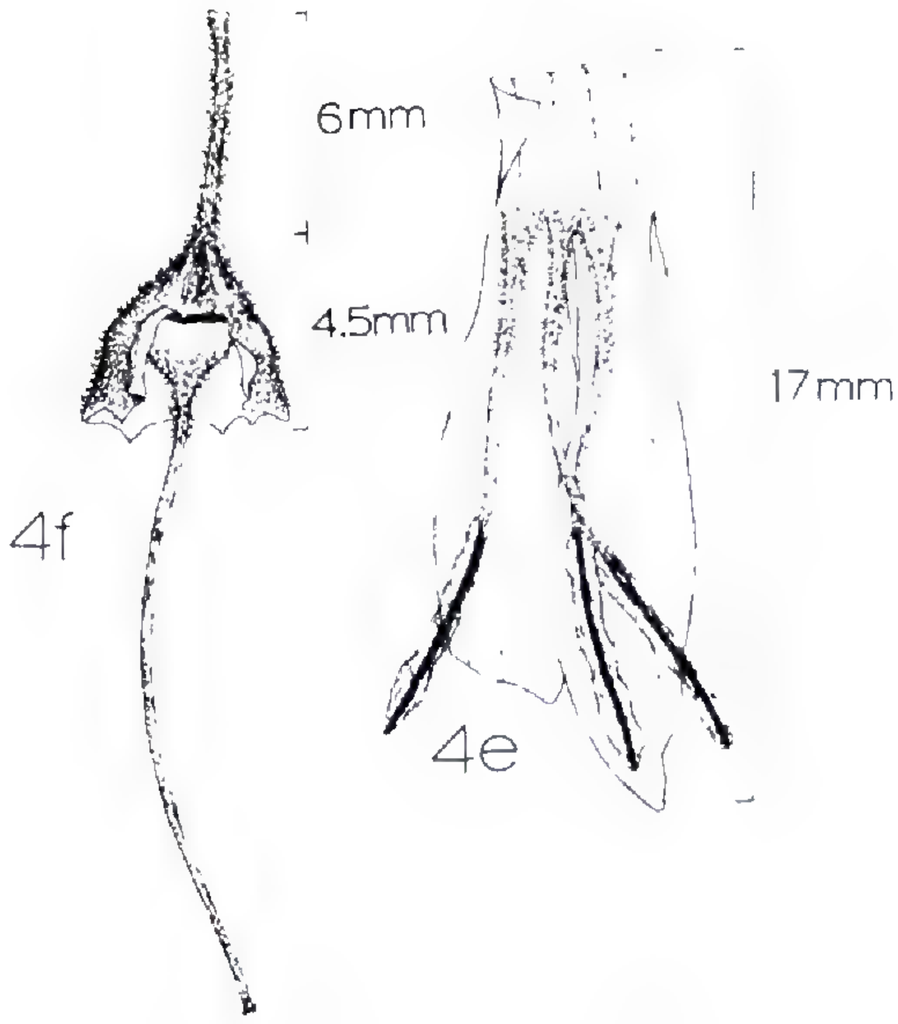


Fig. 3. *Styrax americana* var. *pulverulenta:* a. habit sketch; b, c. upper & lower leaf epidermis (500×); d. trichomes on lower leaf surface (128×); e. mature flower; f. mature fruit.

Fig. 4. *Styrax grandifolia:* a. habit sketch; b, c. upper & lower leaf epidermis (500×); d. trichomes on lower leaf surface (128×); e, f. mature flower parts; g. mature fruit.

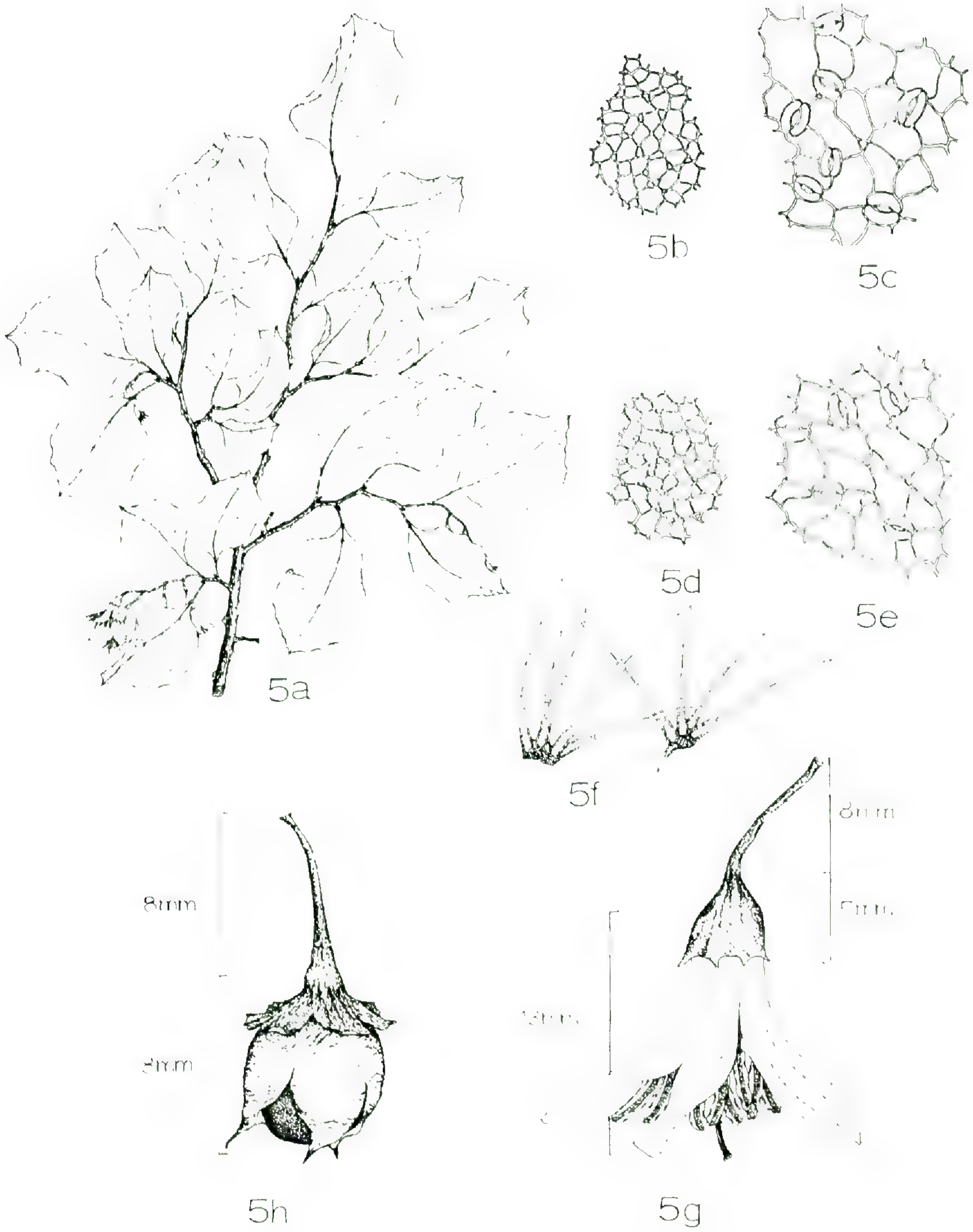
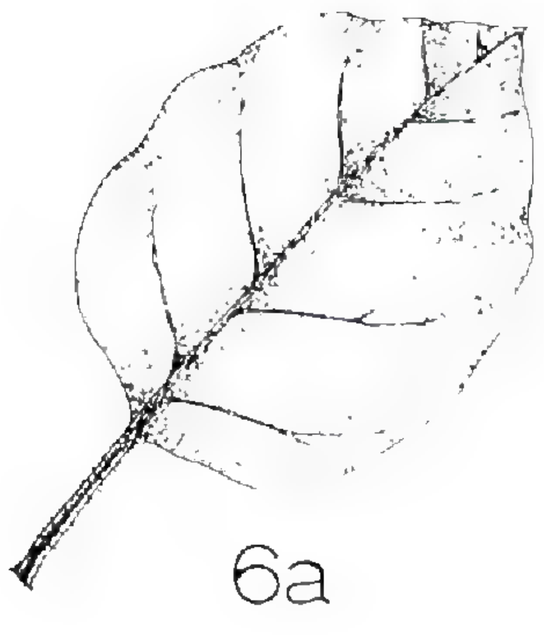


Fig. 5. *Styrax platanifolia*: a. habit sketch; b, c. upper & lower leaf epidermis of var. *platanifolia* (500×); d, e. upper & lower leaf epidermis of var. *stellata* (500×); f. trichomes on lower leaf surface of var. *stellata* (128×); g. mature flower; h. mature fruit.

Fig. 6. *Styrax texana*, *S. youngae:* a. leaf of *S. texana;* b. leaf of *S. youngae;* c, d. upper & lower leaf epidermis of *S. texana* (500×); e, f. upper & lower leaf epidermis of *S. youngae* (500×); g. trichomes on lower leaf surface of *S. texana* (128×); h. trichomes on lower leaf surface of *S. youngae* (128×); i. calyx & pistil of *S. texana;* j. calyx & pistil of *S. youngae*.



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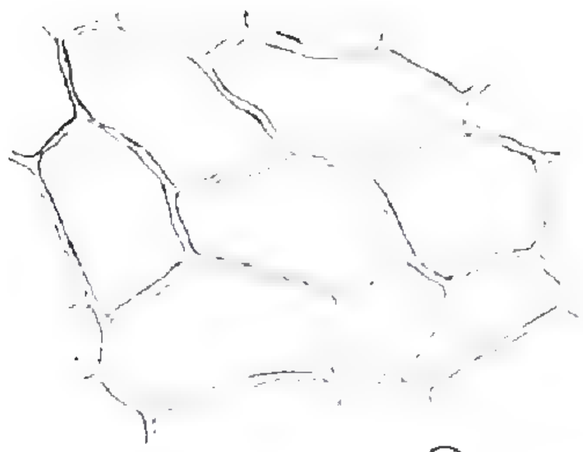

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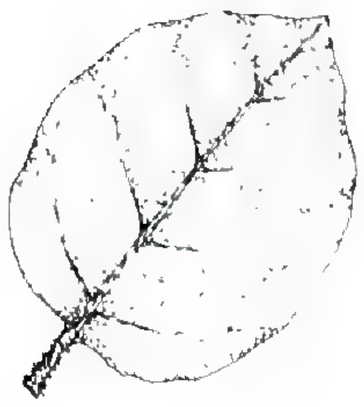

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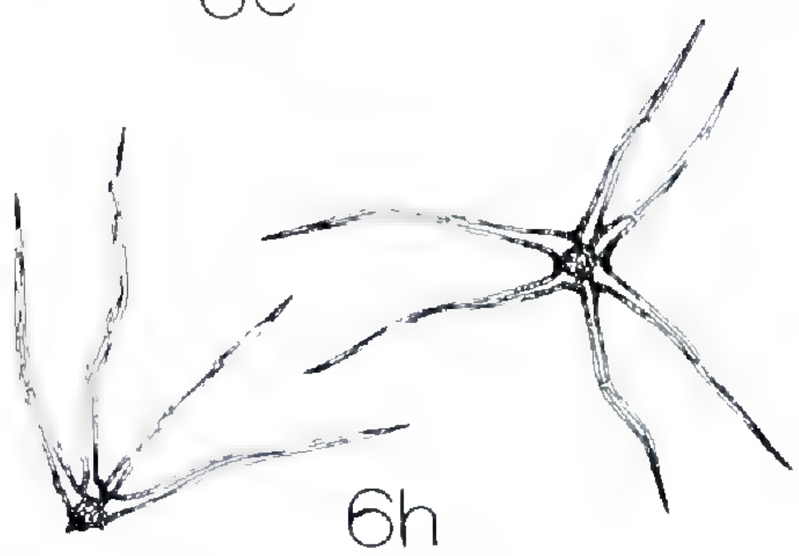
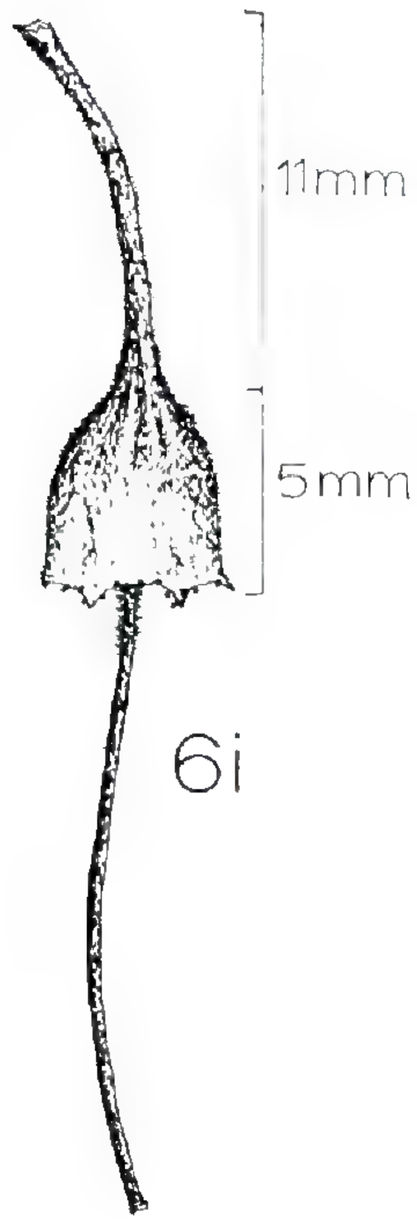
6f

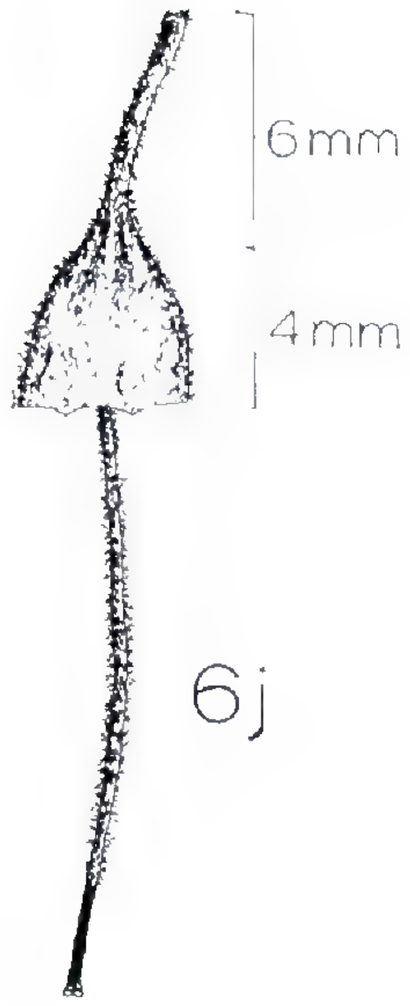
6g



6h



6i



6j

Fig. 7. *Styrax officinalis:* a. habit sketch of var. *californica;* b. c. upper & lower leaf epidermis of var. *californica* (500×); d, e. upper & lower leaf epidermis of var. *fulvescens* (500×); f, g. trichomes on lower leaf surface (128×), and leaf of var. *fulvescens;* h. mature flower; i. mature fruit.

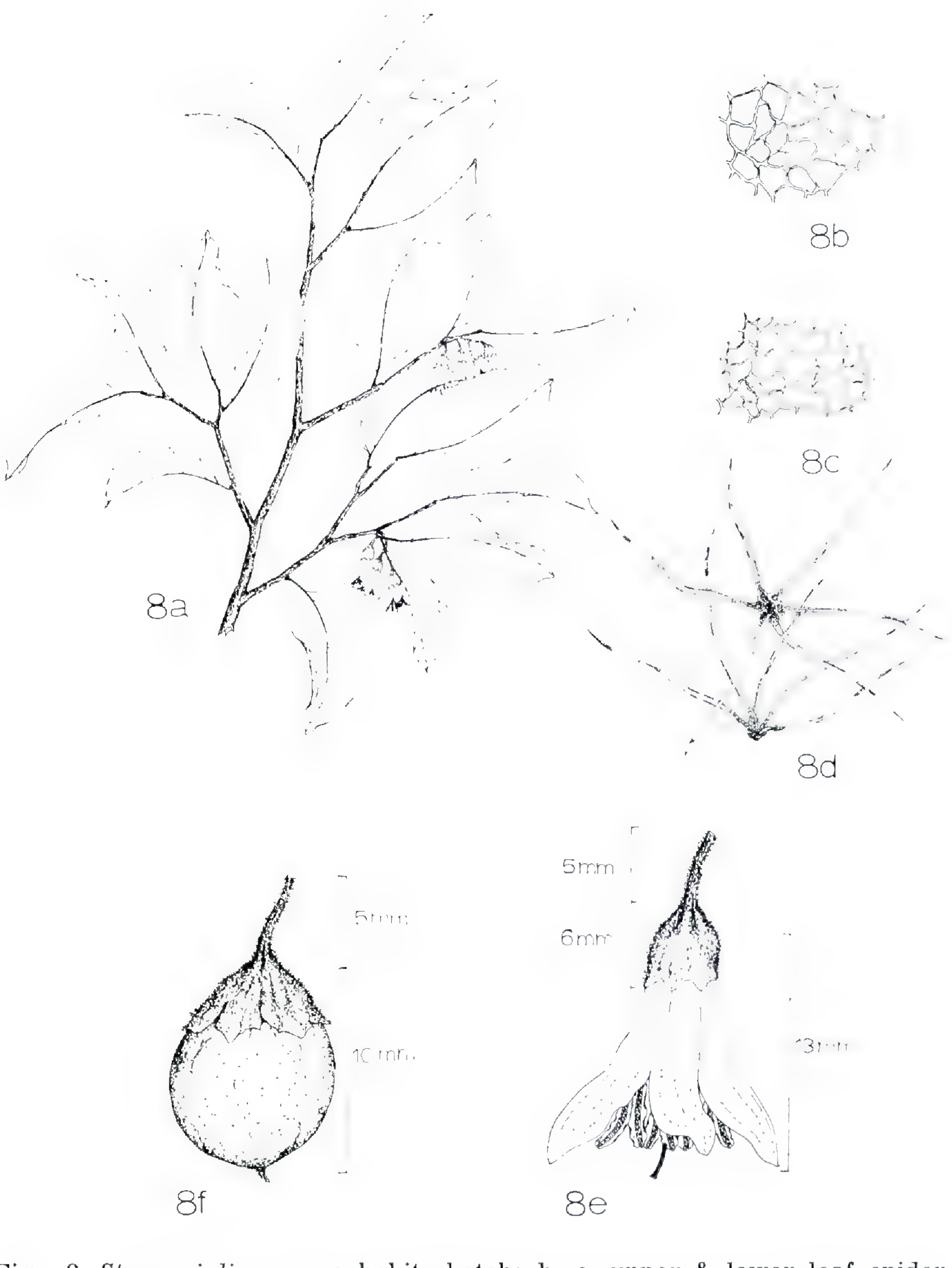
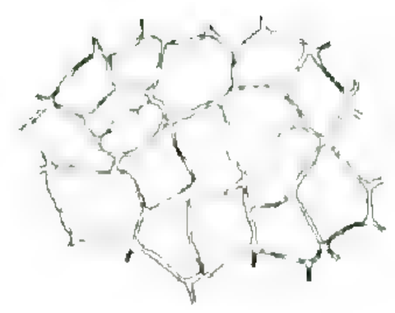


Fig. 8. *Styrax jaliscana:* a habit sketch; b, c. upper & lower leaf epidermis (500×); d. trichomes on lower leaf surface (128×); e. mature flower; f. mature fruit.



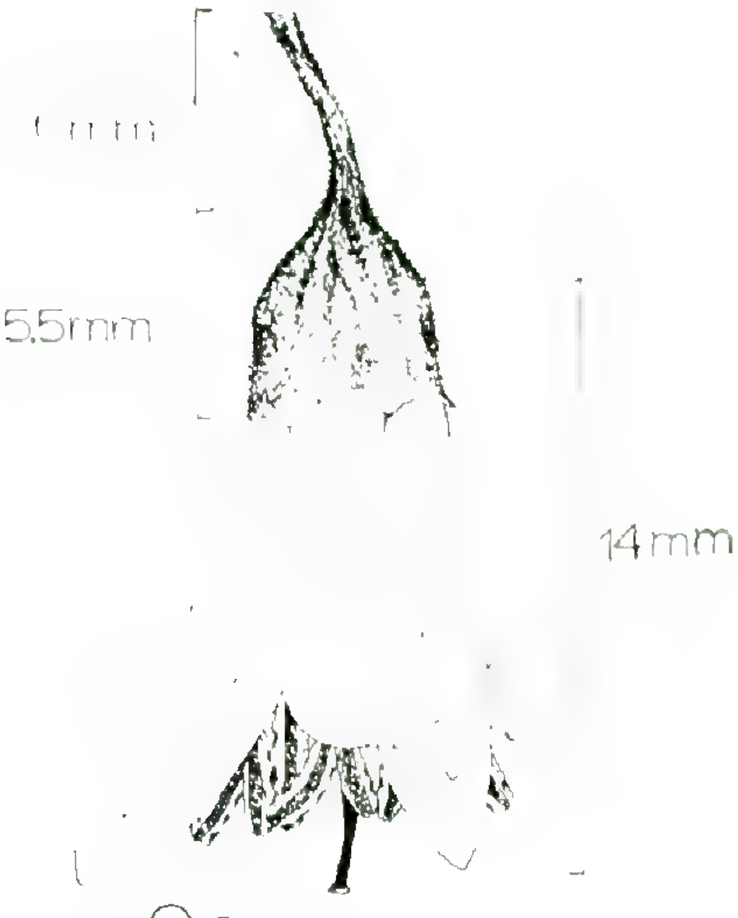


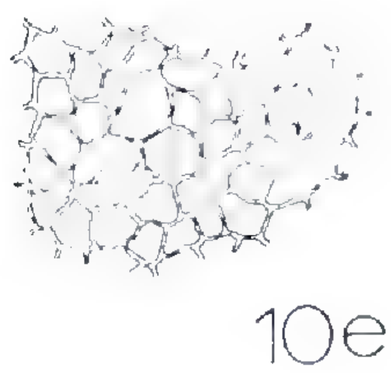
Fig. 9. *Styrax glabrescens*: a. habit sketch; b, c. upper and lower leaf epidermis (500×); d. trichomes on lower leaf surface of var. *pilosus* (128×); e. mature flower; f. mature fruit.

10a

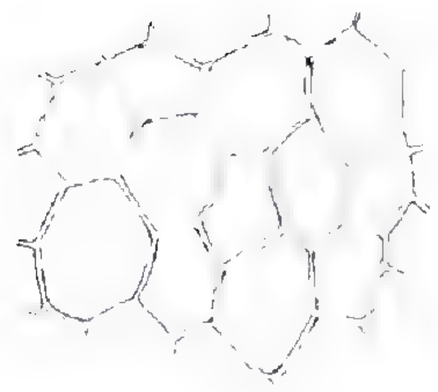
10b

10c

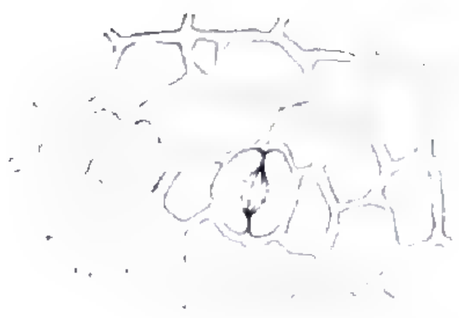
10d



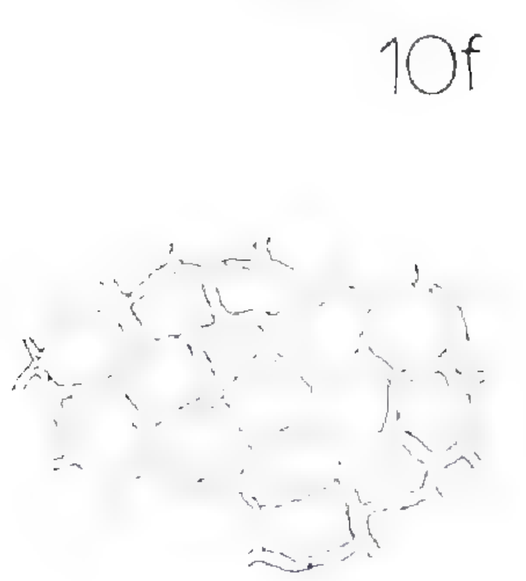
10e



10f



10g



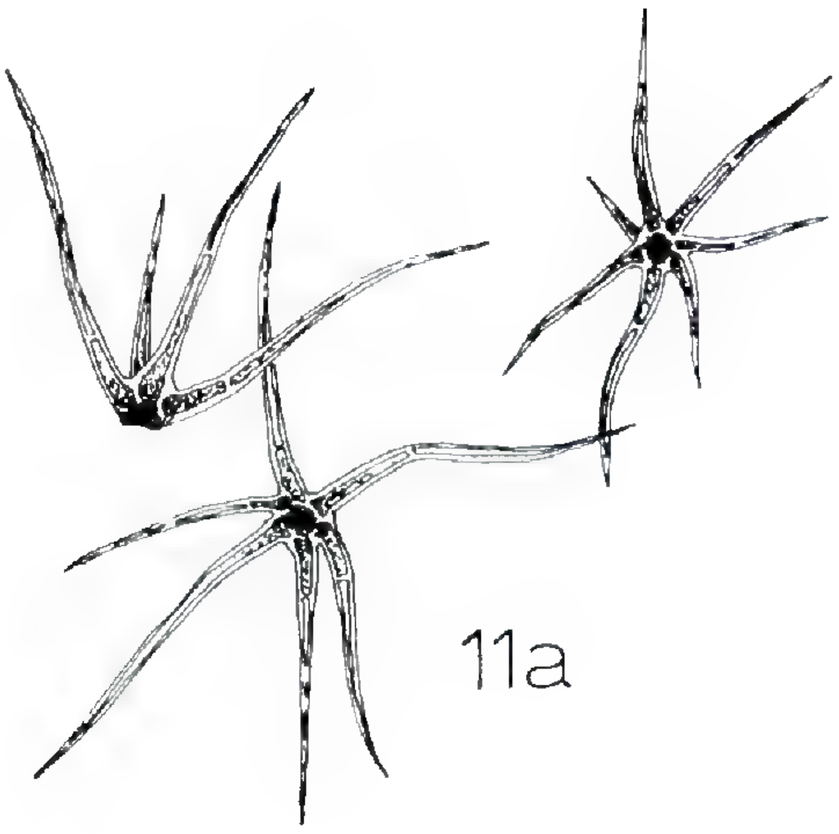
10h

10i

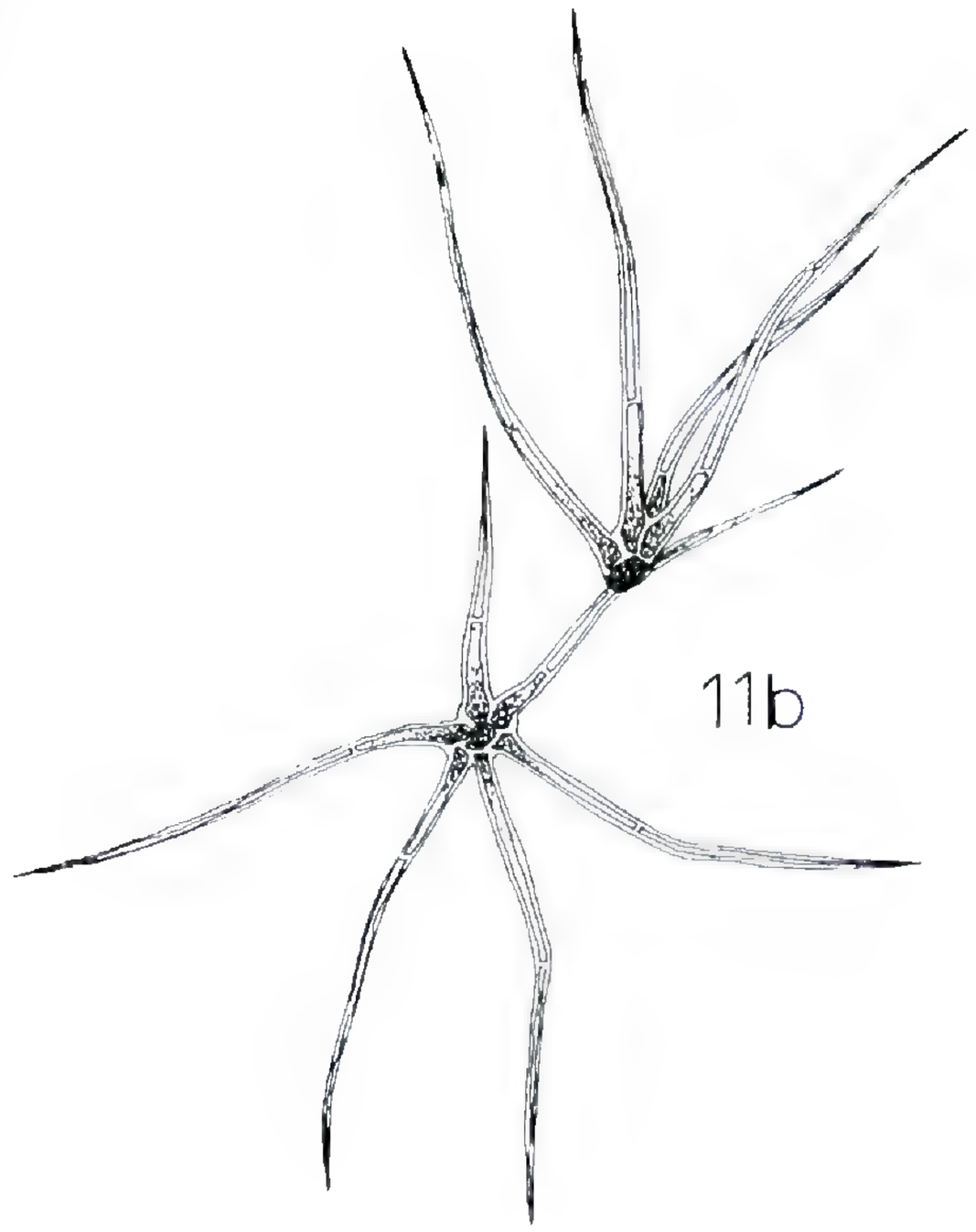
Fig. 10. *Styrax argenteus:* a. leaf of var. *argenteus;* b. leaf of var. *hintonii;* c. leaf of var. *ramirezii;* d, e. upper & lower leaf epidermis of var.

argenteus (500×); f, g. upper & lower leaf epidermis of var. *hintonii* (500×); h, i. upper & lower leaf epidermis of var. *ramirezii* (500×).

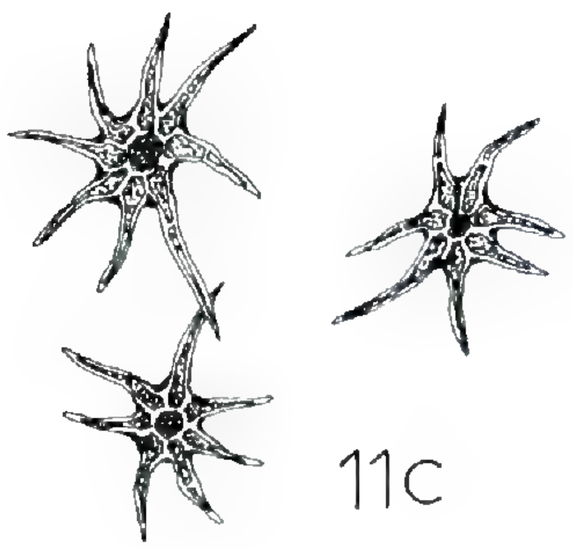
Fig. 11. *Styrax argenteus:* a. trichomes on lower leaf surface of var. *argenteus* (128×); b. trichomes on lower leaf surface of var. *hintonii* (128×); c. trichomes on lower leaf surface of var. *ramirezii* (128×); d. mature flower of var. *argenteus;* e. mature fruit of var. *argenteus*.



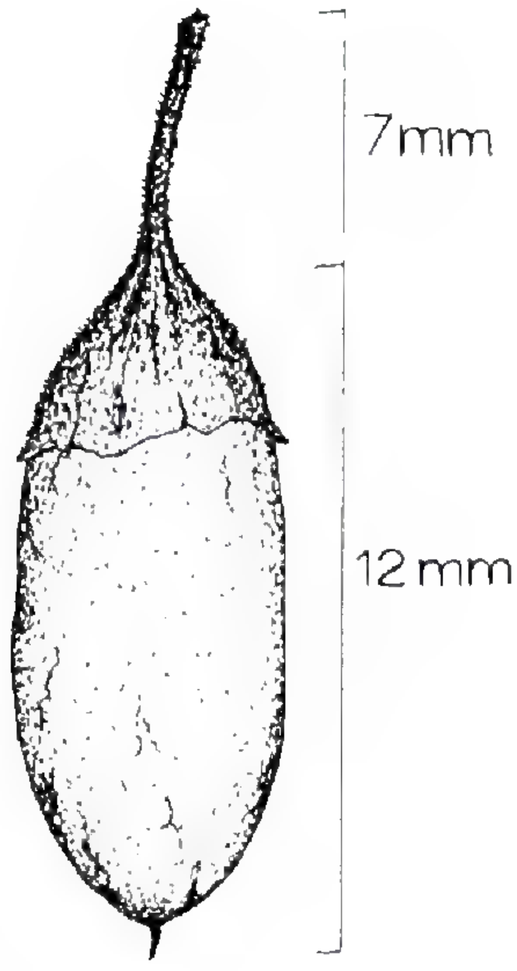
11a



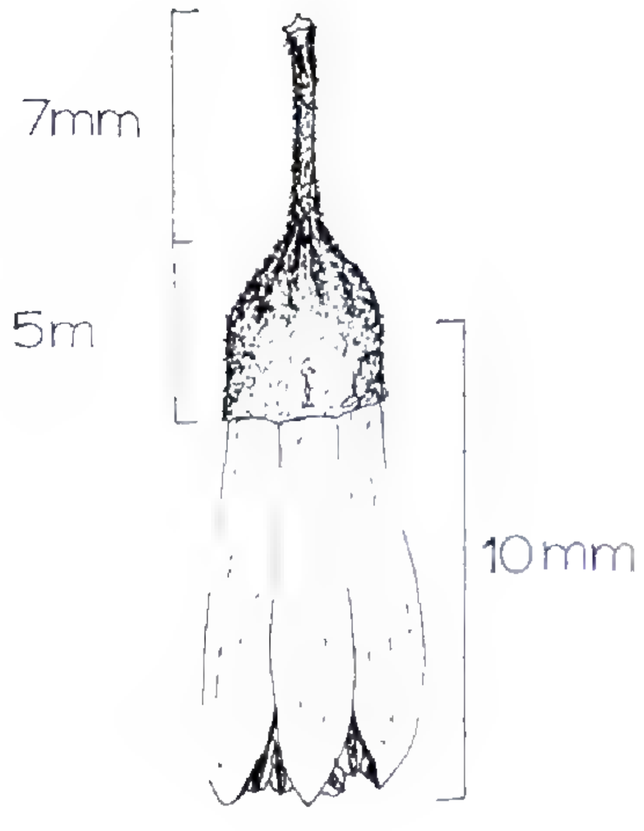
11b



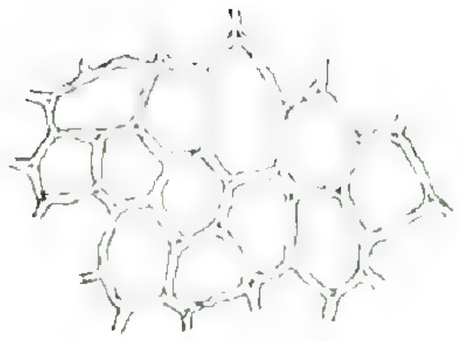
11c

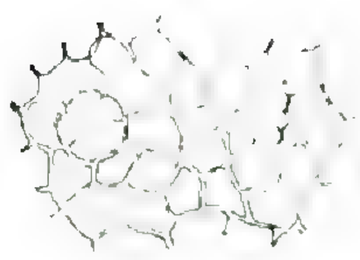


11e



11d





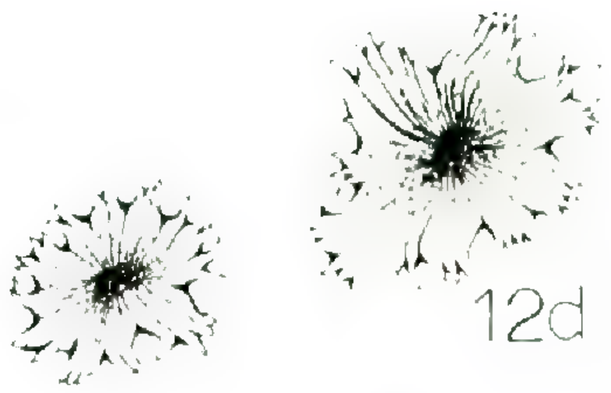
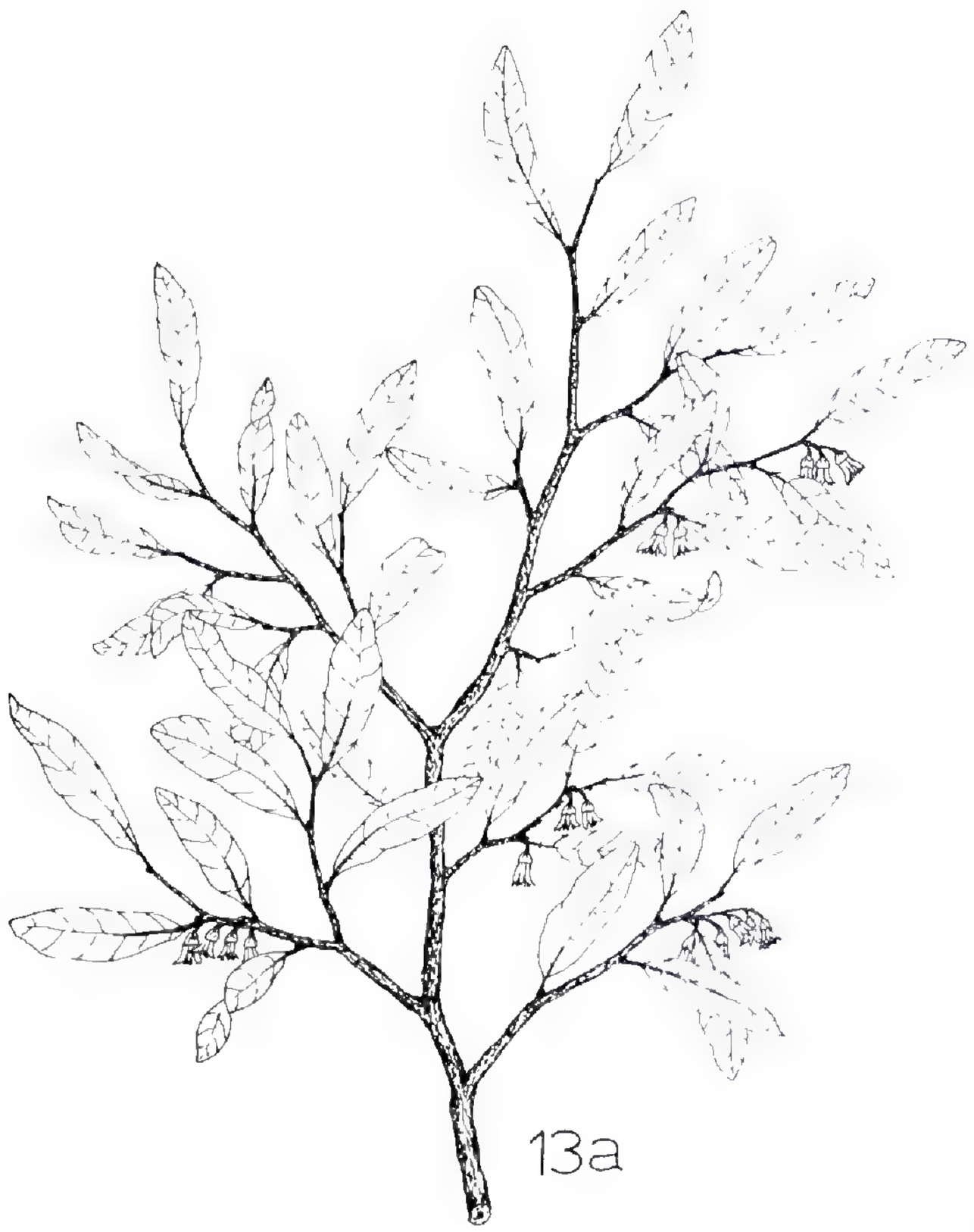
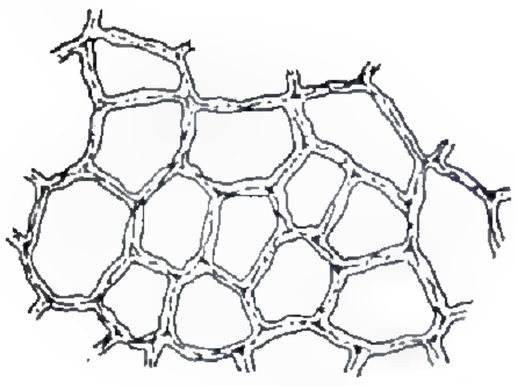


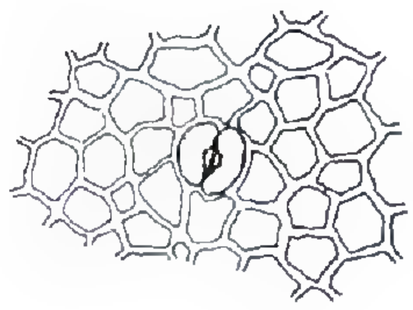
Fig. 12. *Styrax conterminus*: a. habit sketch; b, c. upper & lower leaf epidermis (500×); d. trichomes on lower leaf surface (128×); e. mature flower; f. mature fruit.



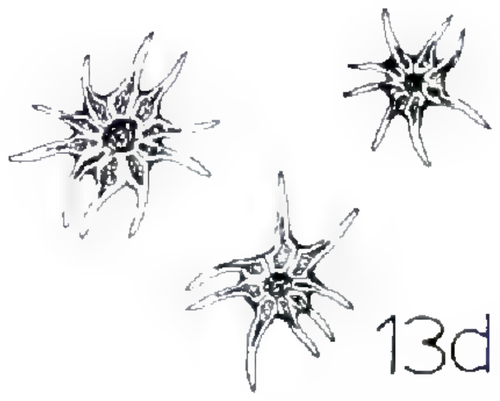
13a



13b



13c



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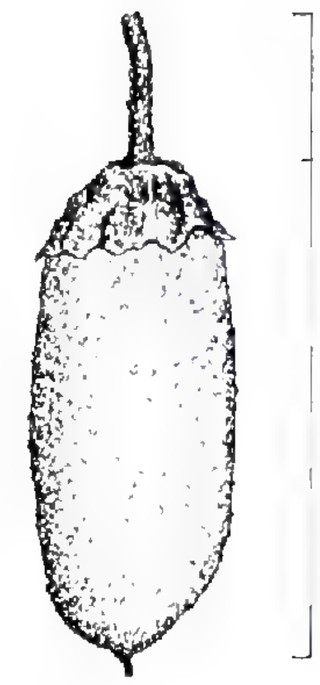
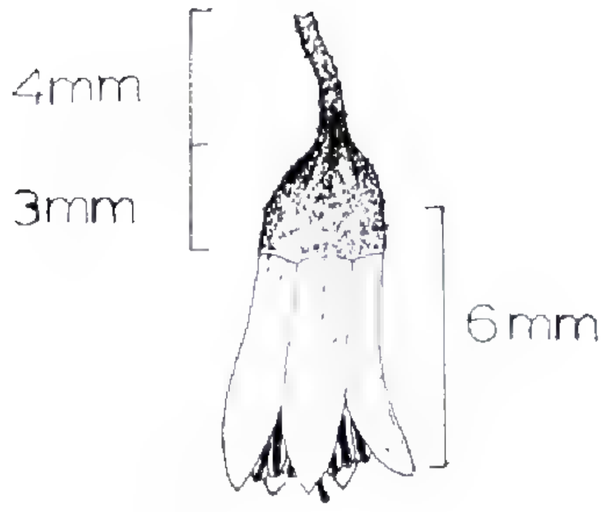


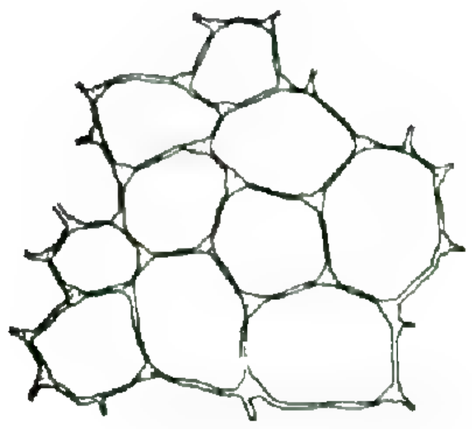
13f



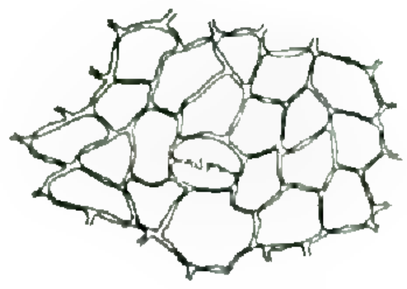
13e

Fig. 13. *Styrax obtusifolia:* a. habit sketch; b, c. upper & lower leaf epidermis (500×); d. trichomes on lower leaf surface (128×); e. mature flower; f. mature fruit.

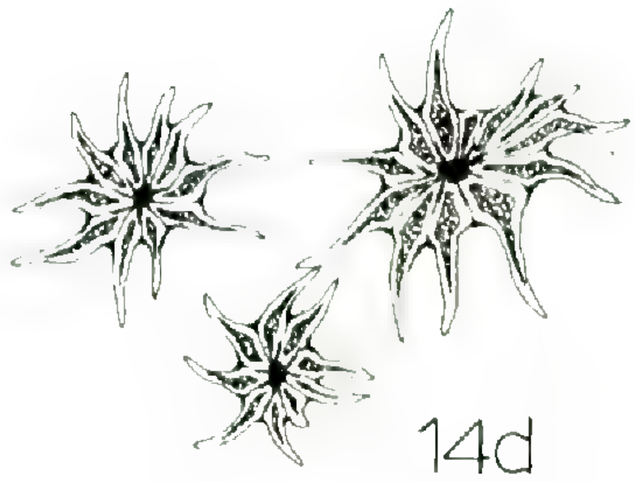
14a



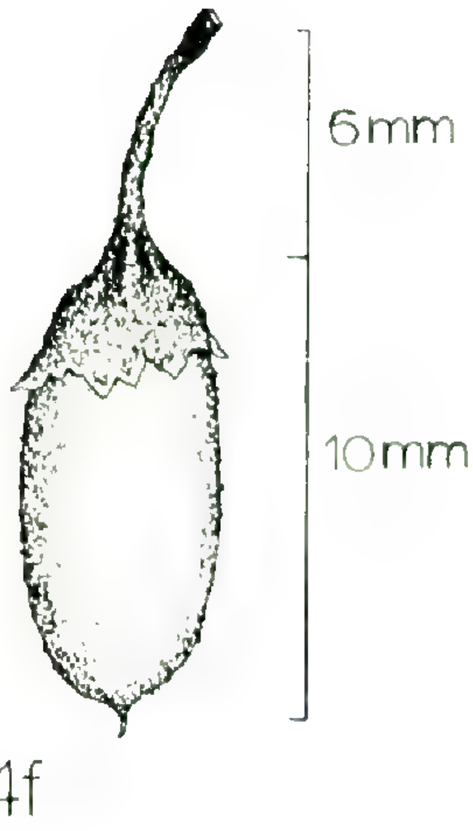
14b



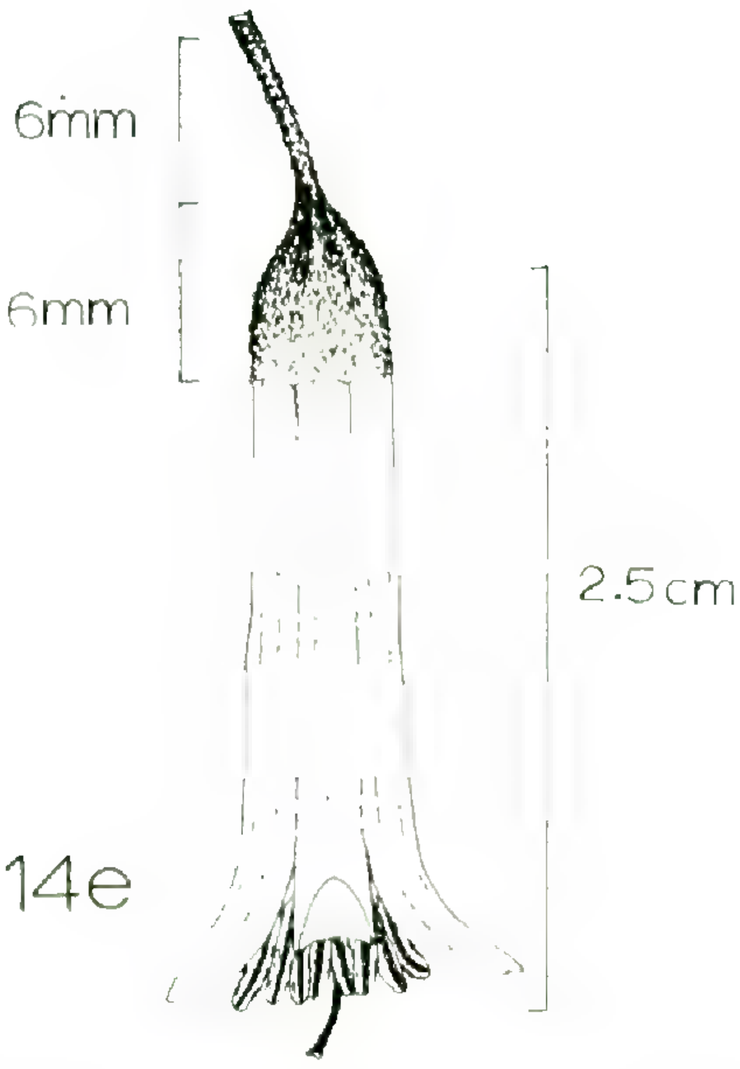
14c



14d

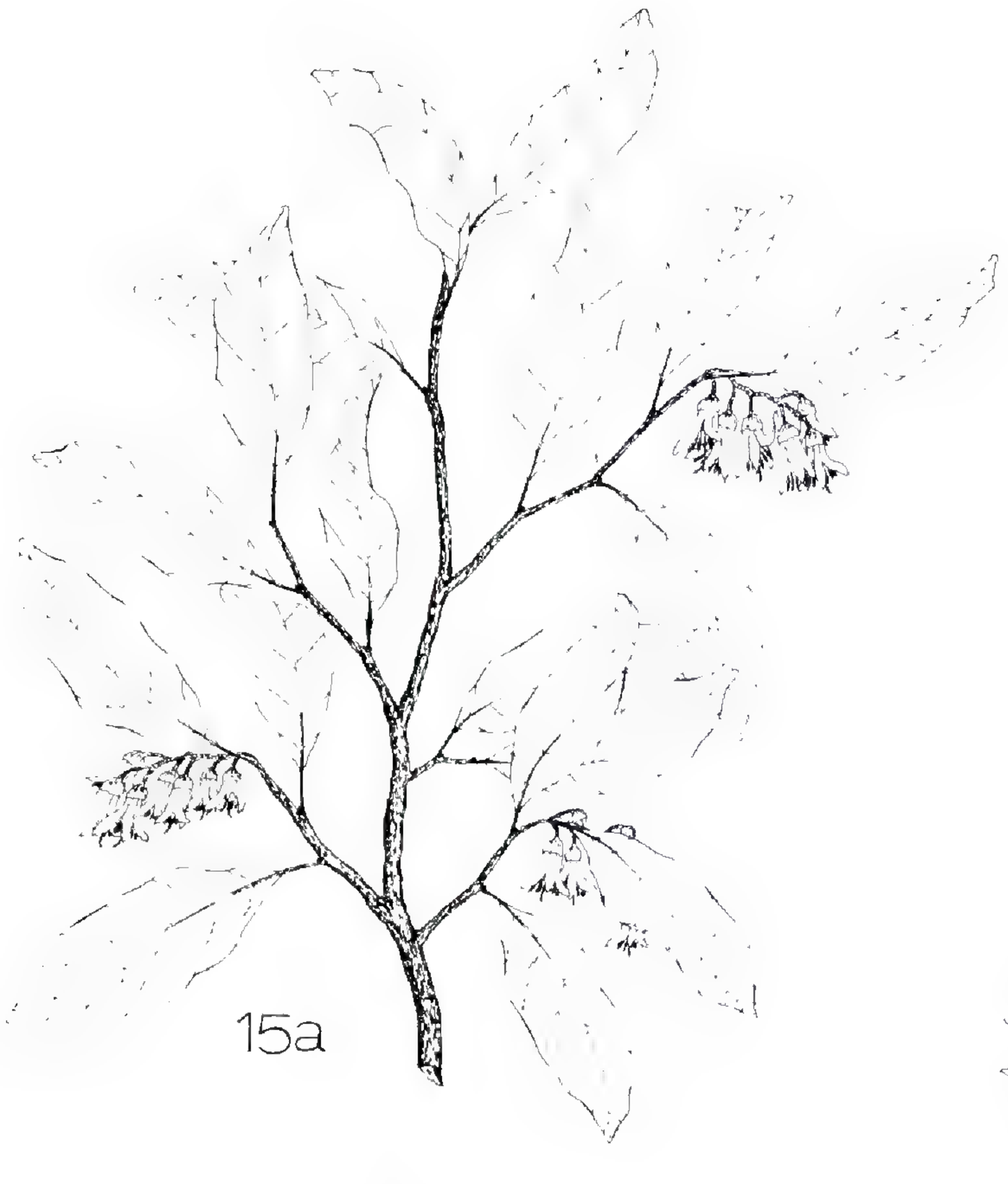


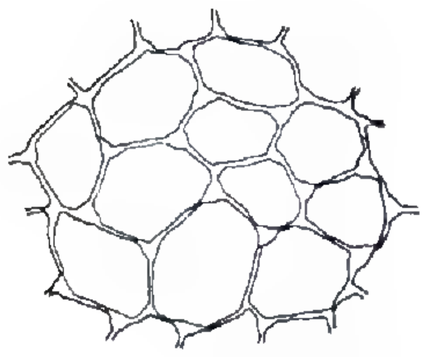
14f

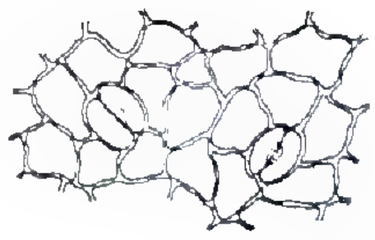


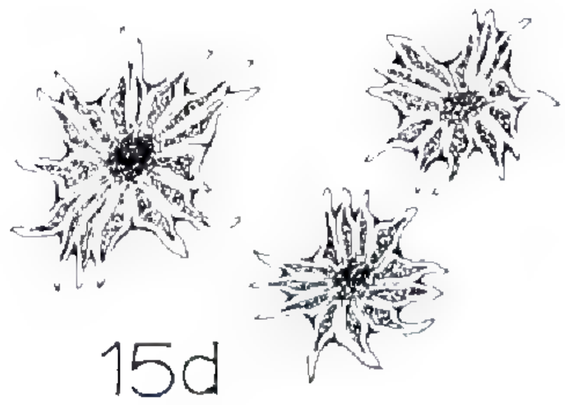
14e

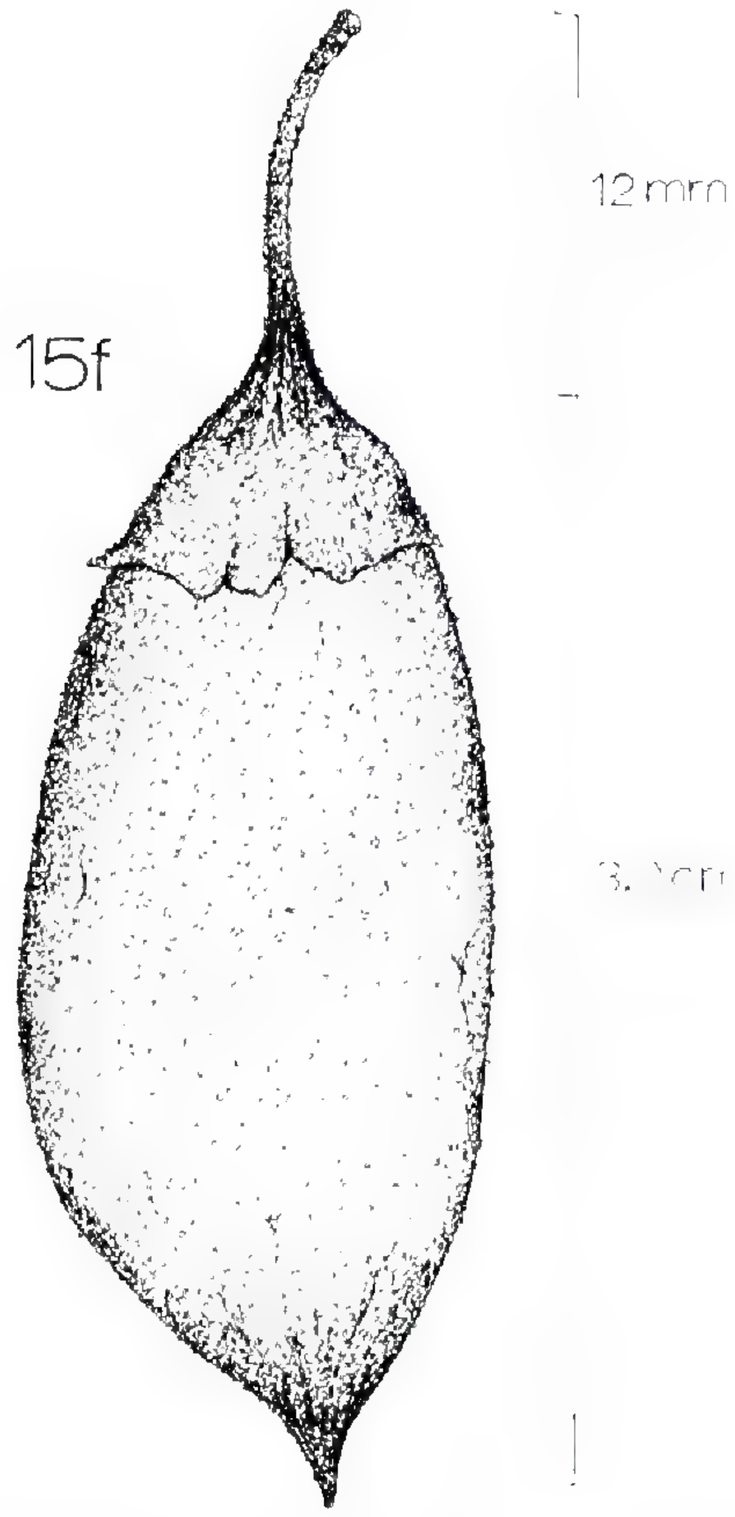
Fig. 14. *Styrax ochraceus:* a. habit sketch; b, c. upper & lower leaf epidermis (500×); d. trichomes on lower leaf surface (128×); e. mature flower; f. mature fruit.











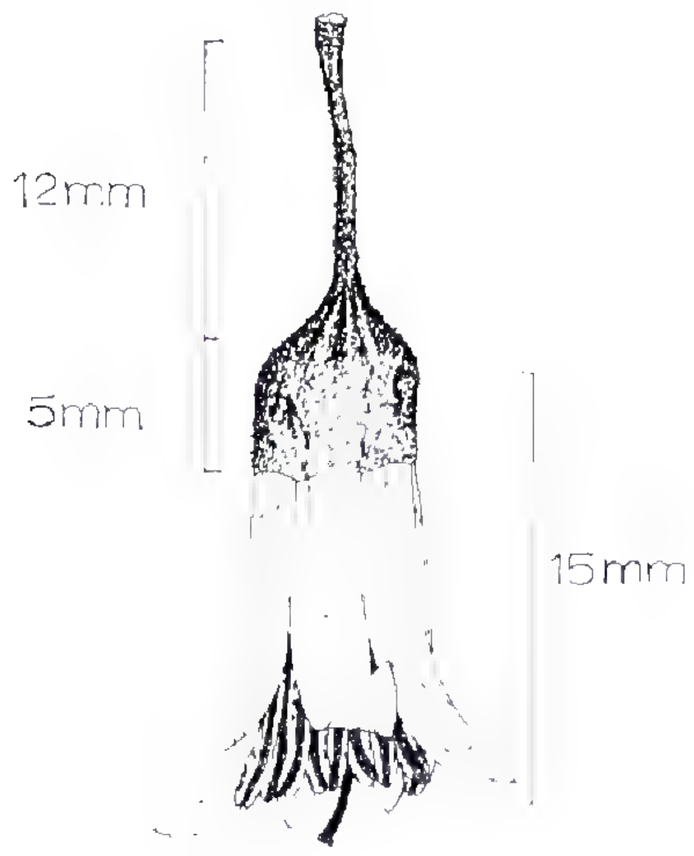
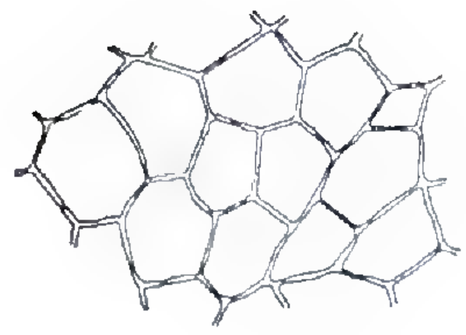


Fig. 15. *Styrax portoricensis:* a. habit sketch; b, c. upper & lower leaf epi-

dermis (500×); d. trichomes on lower leaf surface (128×); e. mature flower; f. mature fruit.

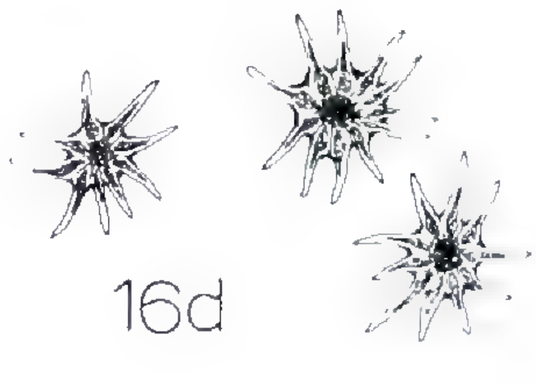
Fig. 16. *Styrax glaber:* a. habit sketch; b, c. upper & lower leaf epidermis (500×); d. trichomes on lower leaf surface (128×); e. mature flower; f. mature fruit.

16a

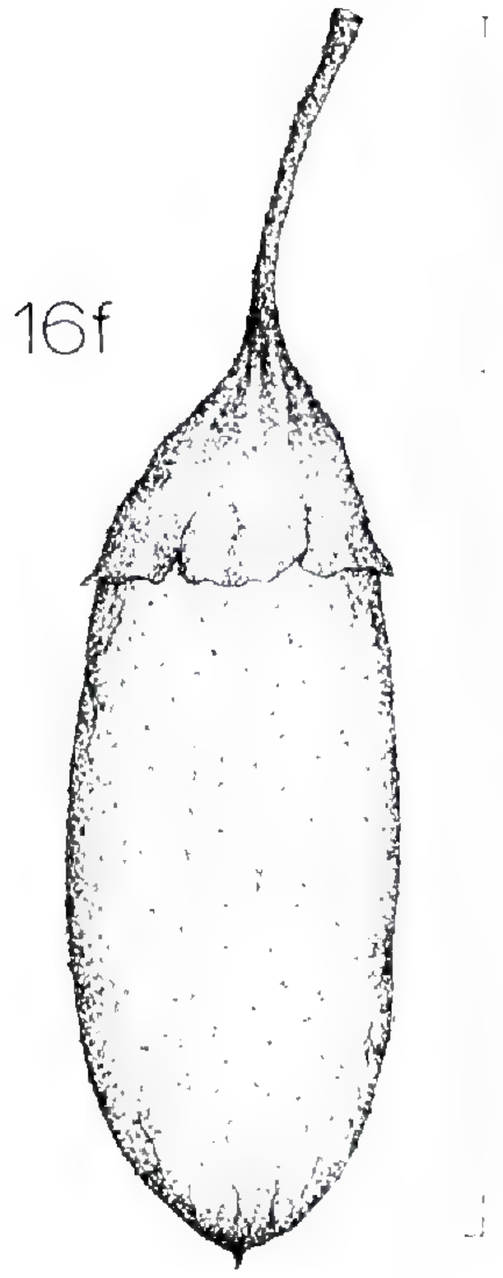


16b

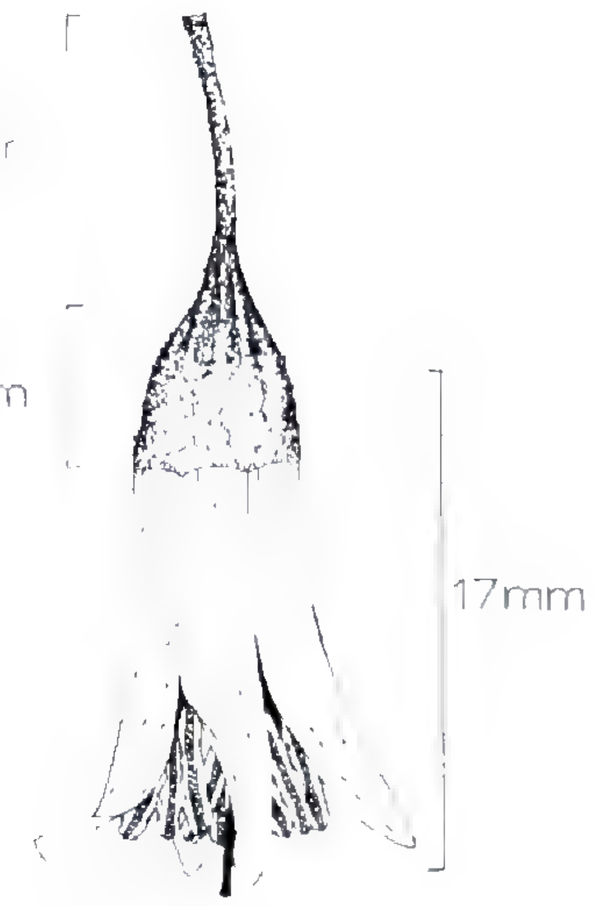
16c



16d



16f



16e

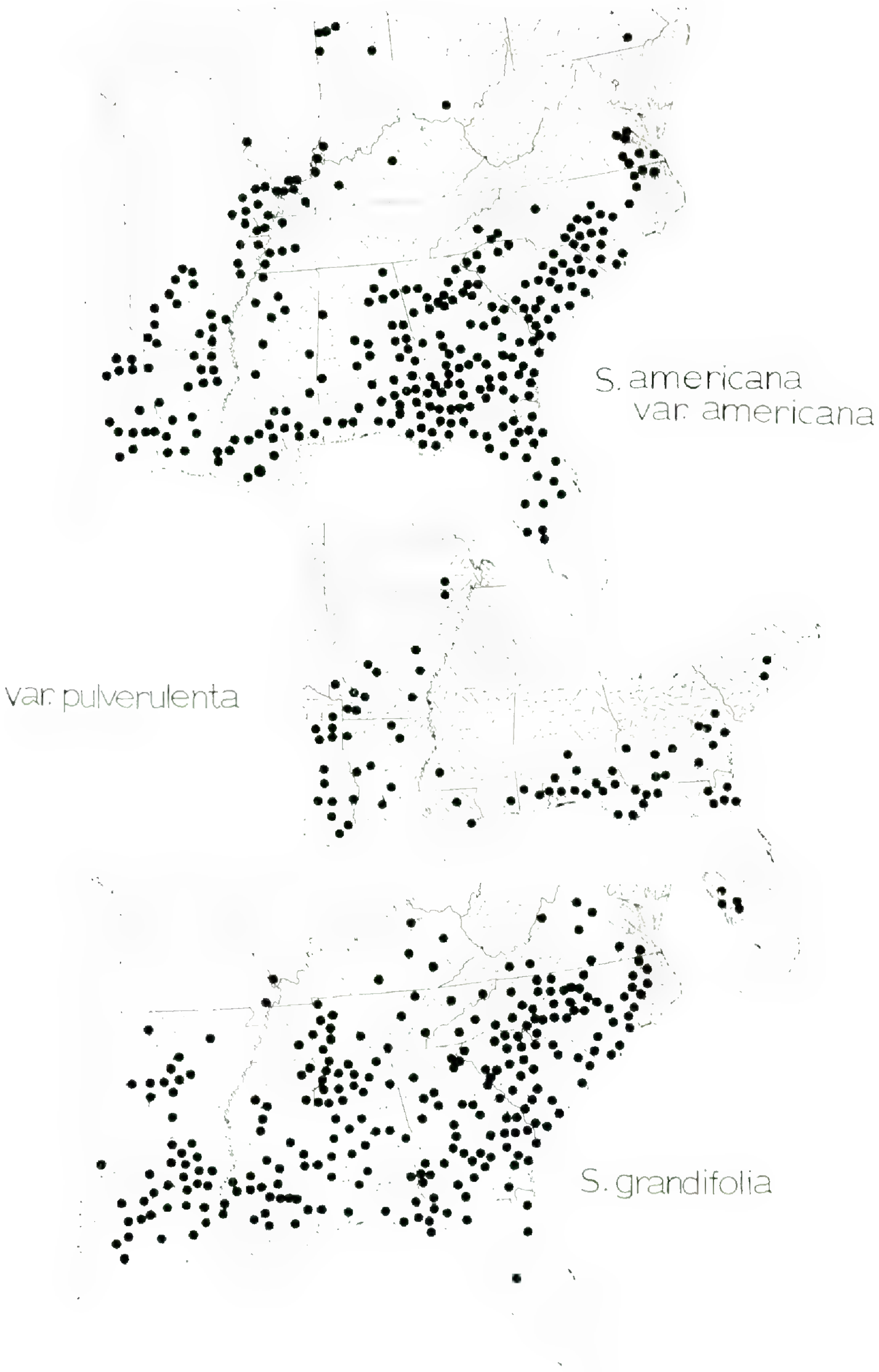
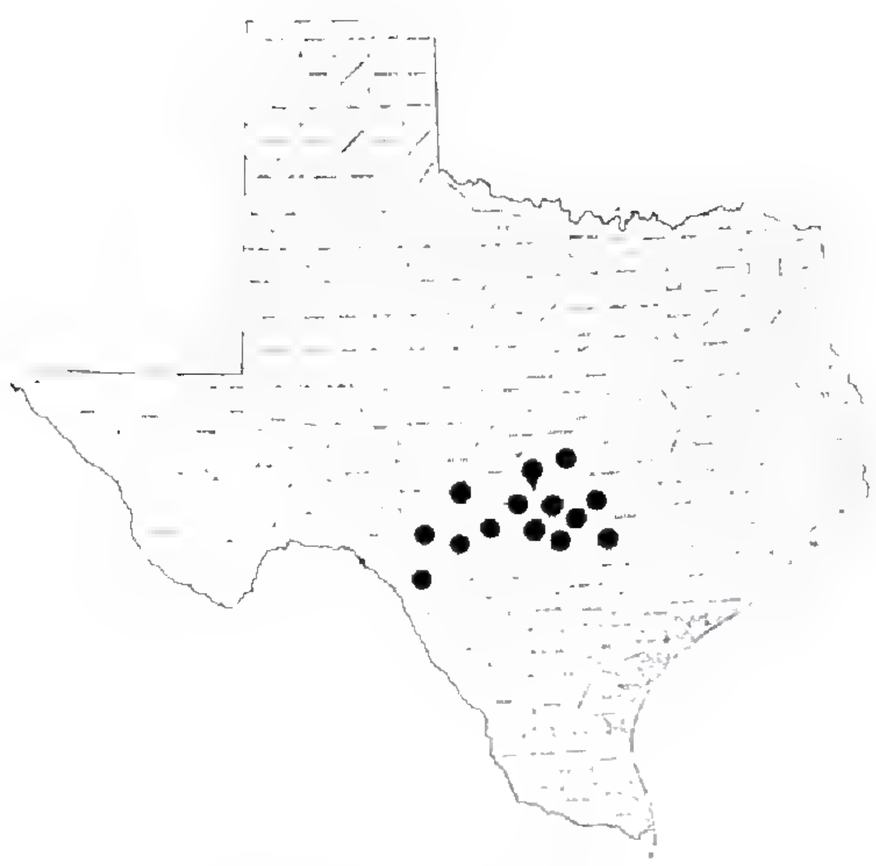
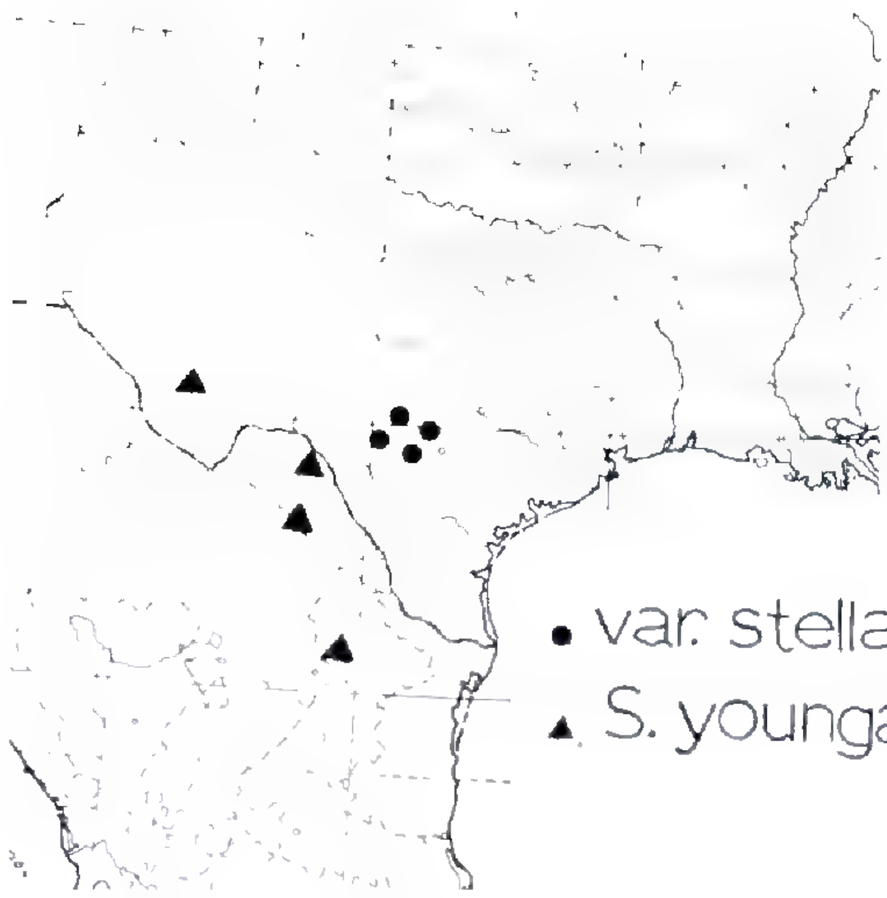


Fig. 17. Documented distribution of *Styrax americana* var. *americana*, *S. americana* var. *pulverulenta*, and *S. grandifolia*.



S. platanifolia
var. platanifolia

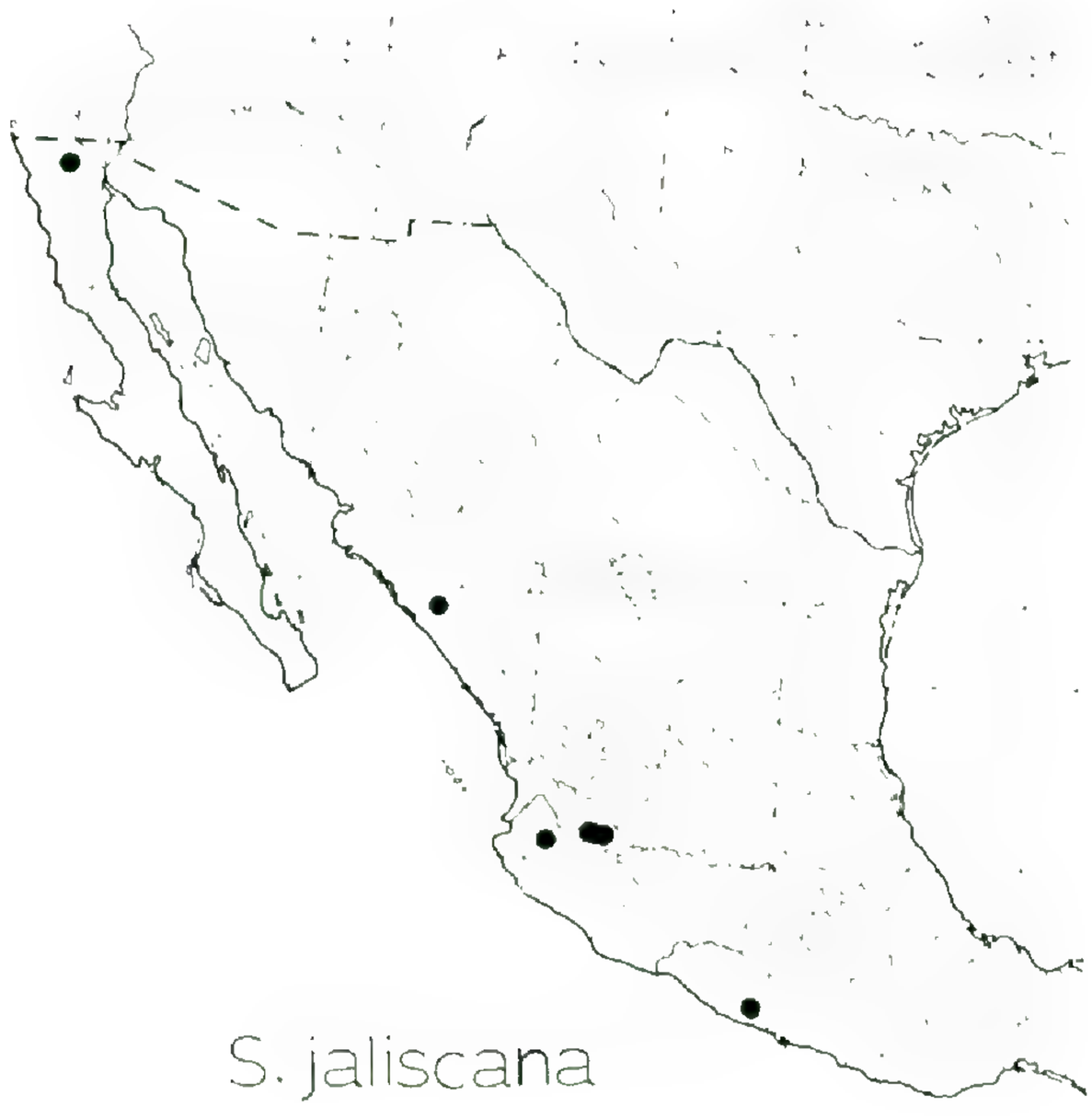


S. texana

S. officinalis
var. californica

var. fulvescens

Fig. 18. Documented distribution of *Styrax platanifolia* var. *platanifolia*, *S. platanifolia* var. *stellata*, *S. youngae*, *S. texana*, *S. officinalis* var. *californica*, and *S. officinalis* var. *fulvescens*.



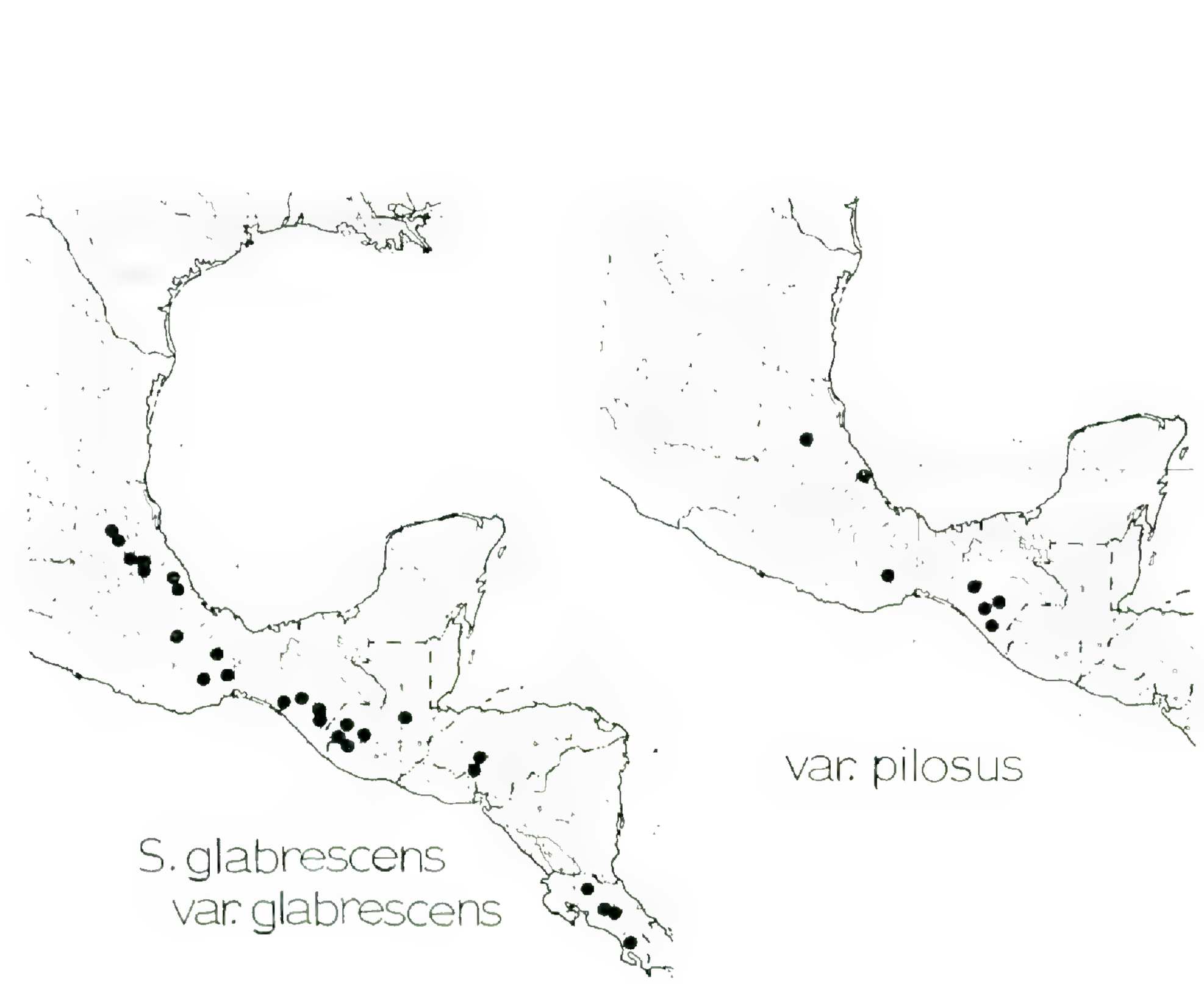


Fig. 19. Documented distribution of *Styrax jaliscana*, *S. conterminus*, *S. glabrescens* var. *glabrescens*, and *S. glabrescens* var. *pilosus*.

Fig. 20. Documented distribution of *Styrax argenteus* var. *argenteus*, *S. argenteus* var. *ramirezii*, and *S. argenteus* var. *hintonii*.

Fig. 21. Documented distribution of *Styrax obtusifolia*, *S. ochraceus*, *S. portoricensis*, and *S. glaber*.

NOTES ON THE GENUS NAJAS (NAJADACEAE)[1]

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Department of Botany, The Ohio State University, Columbus, 43210
and School of Natural Resources, The University of Michigan,
Ann Arbor, 48104

Najas is a cosmopolitan genus of submersed aquatic plants with its greatest diversity in tropical and subtropical regions. Although floristic treatments have been prepared for certain areas, e.g., eastern United States (Clausen, 1936) and Panama (Wentz and Haynes, 1973), at no time since Rendle (1899) have all of the species, either worldwide or regional, been included in one revisionary treatment. Morphological variability within the group has been poorly understood. Because of the lack of a thorough revisionary treatment and a poor understanding of the taxa, the genus is, we feel, in need of revision. Therefore at the present time, we are revising *Najas* in the Western Hemisphere. During the preparation of this treatment, we recognized two species (*N. ancistrocarpa* Magnus and *N. wrightiana* A. Br.) previously unreported from North America and a new variety of *N. guadalupensis* (Spreng.) Magnus. These three taxa are discussed here.

Najas ancistrocarpa was first collected in the United States by A. H. Curtiss (*6865*) in "tidal creeks" near Milton (Santa Rosa County), Florida on 3 Aug 1901. Fernald (1902) reported these specimens as *N. conferta* A. Br. (a synonym of *N. wrightiana*) and distributed them to many herbaria (GA, GH, MO, NY, UC, US, WIS).

In 1947, R. F. Thorne collected *N. ancistrocarpa* from Open Pond (*5537*, GA) and Cane Water Pond (*5538*, GH, MO, UC) in Decatur County, Georgia. Thorne and W. C. Muenscher revisited the Milton, Florida location in 1948 and again collected the species (*8612a*, F, GA, GH, NY, US). All of the specimens collected by Thorne and Muenscher were identified as *N. conferta*.

Most recently, *N. ancistrocarpa* has been collected in Lake Jackson, Leon County, Florida (*Smith s.n.*, 1972, FSU, OS). This species should be sought in both fresh and brackish waters throughout the southeastern states.

The vegetative organs of *N. ancistrocarpa* resemble those of *N. minor* All. and *N. wrightiana* by the presence of large teeth scattered along the margin of quite narrow leaves. However, *N. ancistrocarpa* is easily distinguished from the last two species by its fruits being so recurved they appear crescent-shaped (Fig. 1). We know of no other *Najas* with such curved fruits.

Najas ancistrocarpa is native to Japan and, according to Miki (1935), has previously been known from only two Japanese islands, Honshiu and Shi-

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[1] Contribution from the Department of Botany, The Ohio State University (Paper No. 863).

SIDA 5(4): 259—264. 1974.

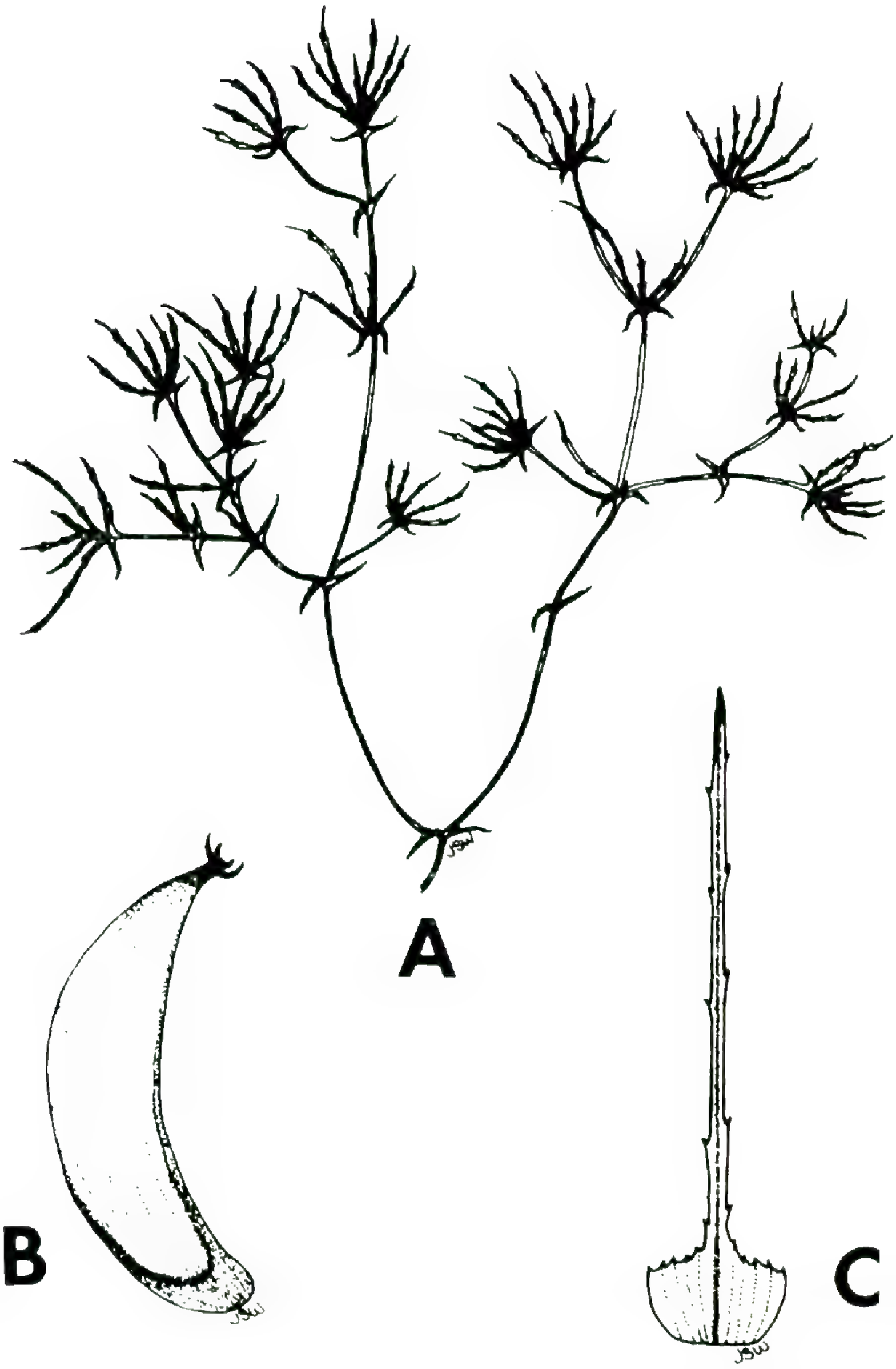

Fig. 1. *Najas ancistrocarpa.* A. Habit sketch (× 1); B. Fruit with involucre (× 9); C. Leaf (× 4½).

koku. In addition to *N. ancistrocarpa*, other species in the aquatic flora of southeastern United States, e.g. *Blyxa aubertii* and *Ottelia alismoides* (Thieret, Haynes, and Dike, 1969), are known to occur in isolated areas of North America and Eastern Asia.

A second species, *N. wrightiana*, has recently been found in the United States. Clausen (1946) gives the range of this species as "Cuba, the coastal plain of Mexico north of the Isthmus of Tehuantepec, and the Yucatan Peninsula." We have seen specimens from the Dominican Republic, Brazil,

Venezuela, Guatemala, and British Honduras. The species is probably widespread throughout the West Indies and Latin America.

Clausen (1946) recognized two subspecies based upon differences in leaf width and number of teeth along the leaf margin. We have examined numerous specimens from throughout the species' range and do not think the segregation of infraspecific taxa is warranted.

The first collections of *N. wrightiana* from the United States are from the Big Cypress Swamp in Collier County, Florida (*Lakela 27796*, "off Turner Road," 24 Oct 1964, FSU, USF; *Lakela 31526*, Remuda Ranch Estates, 30 Jul 1968, USF). The Florida collections of *N. wrightiana* apparently represent the northernmost localities for the species. The collections we have seen are abundantly fruiting, and it is likely that the species will spread throughout southern Florida.

Najas wrightiana is easily distinguished from other North American *Najas* by its large teeth scattered along the margin of quite narrow leaves, its short (1–1.5 mm) erect fruit with 5-angled areolae, and its bushy appearance due to axillary tufts of leaves and very short internodes (Fig. 2).

Variation in vegetative parts (plasticity) within individual taxa of aquatic plants has been recognized in *Callitriche* (Fassett, 1951), *Halodule* (Phillips, 1967), *Nymphaea* (Williams, 1970), *Najas minor* (Wentz and Stuckey, 1971), and *Potamogeton* (Haynes, 1973). These workers concluded that because of this plasticity, the taxonomy of the genera in question should rest primarily on reproductive characters. As a result of our own field work and the examination of several thousand specimens we conclude that much of the variability of *N. guadalupensis* is vegetative plasticity and not of genetic origin. Clausen (1936), Ooststroom (1939), and Wentz and Haynes (1973) discussed variability within *N. guadalupensis* and suggested that the complex should possibly be considered as several closely related species.

It is possible that some taxonomists might consider this variation worthy of taxonomic recognition at the varietal level. We, however, regard varieties as morphogeographic subdivisions of a species that presumably reflect genetic differences (Kapadia, 1963). Thus far, in *N. guadalupensis*, we have found a definite correlation between a morphological type and its geographic distribution only in a population in Florida. We have decided to consider the Florida population at the varietal level and not to give the other variants taxonomic rank. Clausen (1936) also mentioned that this population might be worthy of taxonomic recognition.

The nomenclature of *N. guadalupensis* is difficult to explain. The taxon was named as *Caulinia guadalupensis* by Sprengel (1825). The original specimen, subsequently deposited at Berlin, was destroyed during World War II (Gerloff, personal communication). We are uncertain which variety Sprengel had before him. However, having seen specimens of only one variety from Guadaloupe—(the type locality), we consider that taxon as the typical variety. Several other varietal names of *N. guadalupensis* have been proposed. We have examined specimens of these and consider them to be the

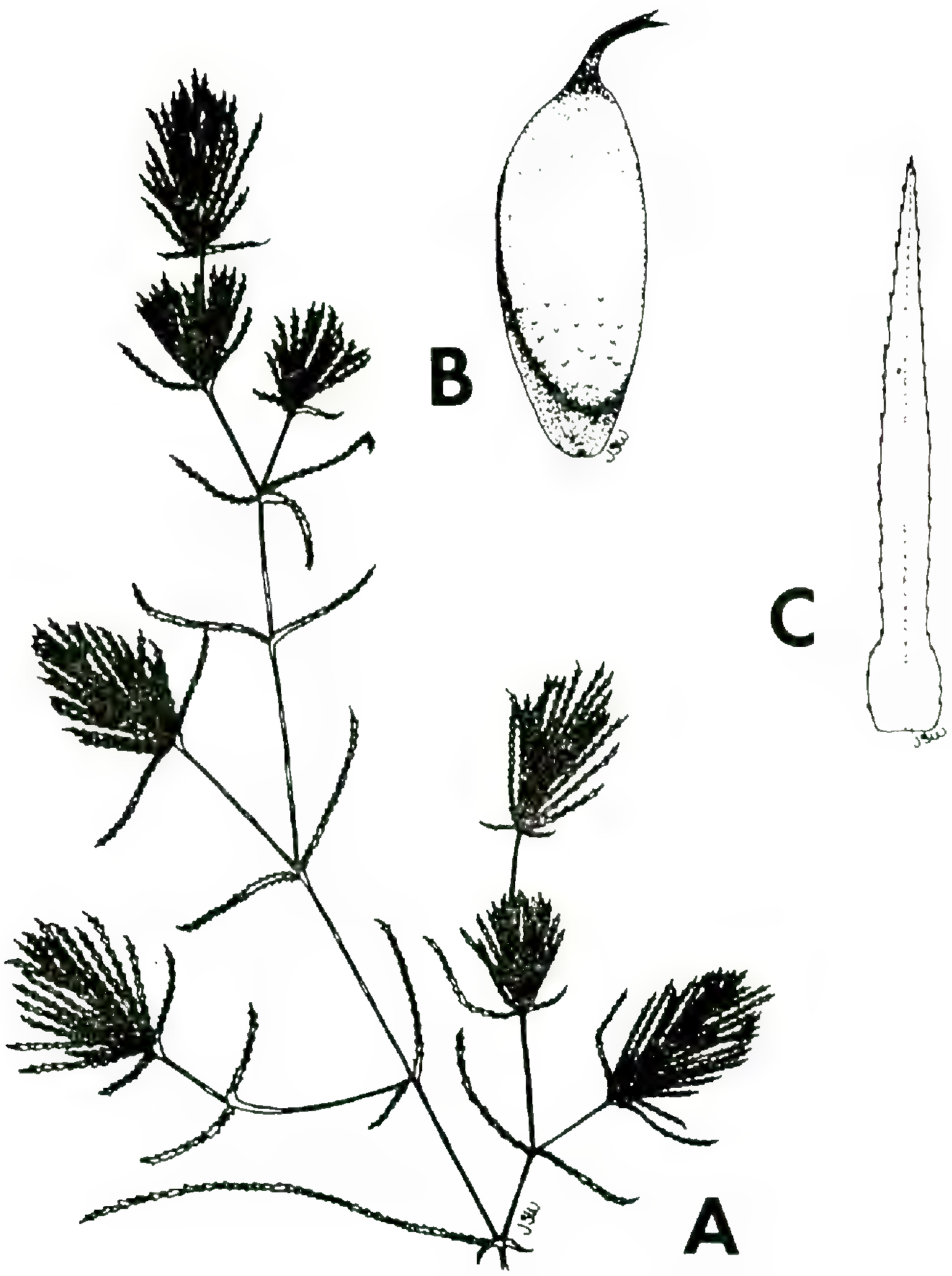

Fig. 2. *Najas wrightiana.* A. Habit sketch (× ¾); B. Fruit with involucre (× 25); C. Leaf (× 2½).

same taxon that occurs in Guadaloupe. Thus, the taxon limited to Florida has no varietal name. We therefore propose:

NAJAS GUADALUPENSIS (Sprengel) Magnus var. **floridana** Haynes & Wentz, var. nov.

Plantae glabrae, monoeciae. Caules 7–51 cm longi, 0.1–1.7 mm diametro, profuse ramosi, internodiis 0.1–9 cm longis. Folia 9–32.5 mm longa, divisa in laminas et auriculas. Laminae 0.5–2.1 mm latae, obtusae vel acuminatae apice, mucronatae; margines conspicuo serrulati, dentibus 18–42 unicellularibus, in uno latere; mucro dentibus lateralibus grandiore. Auriculae 1.2–2.5 mm latae, laminis latiores, rotundatae vel gradatim expansae prope basin, dentibus 5–8 in dimidio superiore quoque marginis, nullis prope basin; dentes similares sed illis laminarum grandiores. Flores solitari, staminati in axillis superis, carpellati in axillis interis; involucra ferruginea vel atro-

purpura, raro viridiba. Flores staminati, 1.5–2.4 mm longi; involucra abrupte angustata supra antheras in rostrum, 0.8–1.3 mm longa, apice lobis quatuor acutis; antherae 1–1.6 mm longae, 0.5–0.7 mm latae, theca una; filamenta demum 1–2.3 mm longa, basi dilatata. Flores carpelleti, 1–3.5 mm longi, fusiformes; involucra supra ovarium abrupte angustata in rostrum, 0.3–1.5 mm longa, findentia opposita carinae, apice lobis acutis tribus vel quatuor; styli usque ad 0.7 mm longi, lobis stigmaticis duobus, extendis supra rostrum involucrale. Fructus 1.6–2.2 mm longi, 0.3–0.8 mm lati, straminei vel perpallidi-viridi, fusiformes; costa una, basaliter complanata, carinata; areolae inconspicuae, latiores quam longae, usque ad 0.1 mm longae, usque 0.2 mm latae, quatuor vel quinque angulatae, circa 20 serialibus longitudinalibus; semina fusiformia, stramineus vel lignicolor, extremis fuscatis.

HOLOTYPE: UNITED STATES: FLORIDA: Dade Co.: abundant in brackish water of ditch along St. Rt. 94 (east end) off U.S. Rt. 41 at edge of Everglades National Park, ca. 40 miles W of Miami, 5 Apr 1972, *W.A. Wentz 670* (US!; isotypes, GH! MICH! OS!).

The new variety (Fig. 3) can be distinguished from the typical variety by its longer fruits (1.6–2.2 mm for var. *floridana* and less than 1.6 mm for var. *guadalupensis*). Also the leaves of the new variety at maturity are usually 2–3.5 cm long with 18–42 macroscopic teeth per side, while those of the typical variety are smaller and have about 100 minute teeth along each side.

Najas guadalupensis var. *floridana* is widely distributed in rivers, streams, and ponds throughout Florida and Georgia. It is especially common in the Big Cypress Swamp and the Everglades region of southern Florida.

ACKNOWLEDGEMENTS

We are grateful to Dr. Tod F. Stuessy for assistance with the Latin description; to Dr. David J. Keil and Mr. Marvin L. Roberts for reading the manuscript; to the curators of herbaria from which specimens were borrowed; to Mrs. Jan S. Wentz for the illustrations; and to Mr. Howard F. Schnepp who made it possible to conduct field work in Florida during April 1972.

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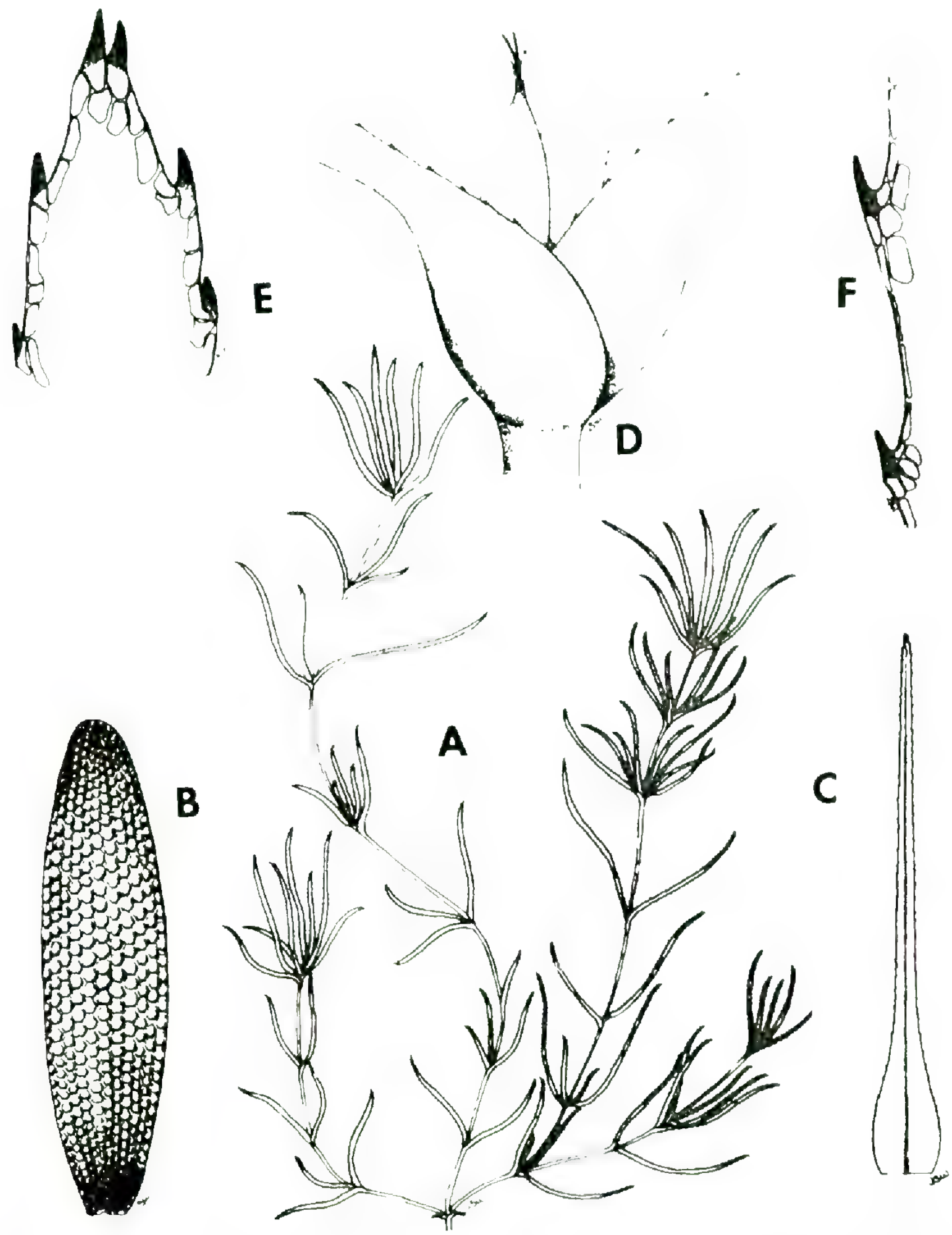

Fig. 3. *Najas guadalupensis* var. *floridana*. A. Habit sketch (× ¾); B. Fruit without involucre (× 25); C. Leaf (× 2½); D. Leaf axil with fruit (× 9); E. Leaf apex (× 30); F. Leaf margin (× 30).

A NEW SUBFRUTICOSE ERIOGONUM (POLYGONACEAE) FROM NORTHERN MEXICO

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Recent floristic studies by B.L. Turner of the University of Texas on vegetation restricted to gypsophilous soils in southwestern United States and adjacent northern Mexico have resulted in the discovery of several interesting plants (Turner, 1972a, 1972b; Turner & Powell, 1972). Among the collections obtained by Turner from near San Roberto Junction in Nuevo León is a new *Eriogonum* (Polygonaceae) here described as:

ERIOGONUM **turneri** Reveal, sp. nov. A *E. jamesii* Benth. in DC. var. *undulata* (Benth. in DC.) Stokes ex Jones foliis lanceolatis 6–11(15) mm longis et 4–5(6) mm latis, inflorescentiis compactis capitatis vel biumbellatis, plantis subfruticosis et compactis differt. *Plantae* caespitosae et subfruticosae 2–10 cm altae et 5–15(20) cm latae, apicibus lignosis et ramosissimis; *folia* lanceolata, laminis 6–11(15) mm longis et 4–5(6) mm latis, subtus albo-tomentosis, supra glabris vel subglabris, marginibus crispatis, petiolis brevibus et 3–6 mm longis, floccosis; *caules* graciles, (1.5)2–5 cm longi, tomentosi; *inflorescentiae* capitatae vel biumbellatae, ad 4 cm longae et latae, ramis tomentosis; *bracteae* 3–5, 0.7–4 mm longae; *pedunculi* nulli; *involucra* solitaria, campanulata, 3–3.5 mm longa et 3.5–4 mm lata, sparse tomentosa, 5–6–lobatis, bracteolis brevibus, 0.8–1 mm longis et hirsutulosis, pedicellis 3–4 mm longis et glabris; *flores* stipitati, albi vel subrosei, 4.5–6 mm longi, puberuli, tepalis dissimilaribus, extimis tepalis oblongis, 3–3.5 mm longis et 0.9–1.2 mm latis, intimis tepalis spatulatis, 4–5 mm longis et 1.8–2.5 mm latis; *stamina* exserta, 3–4 mm longa, filamentis pilosis basi, antheris roseis vel purpureis, 0.5–0.8 mm longis, oblongis; *achaenia* infuscata, 4–4.5 mm longa.

Low cespitose subfruticose perennials 2–10 cm high with compact, woody caudex branches forming a mat 5–15(20) cm across, this arising from a stout woody taproot, the bark of the caudex branches and the taproot reddish brown, exfoliating in loose shaggy plates; *leaves* basal, in indistinct basal rosettes restricted to the base of the herbaceous flowering stems or at the tips of exposed caudex branches, the leaf blade lanceolate, 6–11(15) mm long, 4–5(6) mm wide, densely white-tomentose below, green and subglabrous to glabrous above, the midvein remaining pubescent above in most, the margin enrolled and crispate, the apex acute, the base truncate to rounded, the petiole short, 3–6 mm long, floccose to thinly tomentose, reddish

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SIDA 5(4): 265—267. 1974.

under the tomentum, the petiole base triangular, 0.8–1 mm long, 0.5–0.8 mm wide, persistent and covering the upper part of the caudex branch, glabrous within, thinly pubescent without; *flowering stems* erect, slender, (1.5)2–5 cm long, thinly tomentose, often reddish under the tomentum; *inflorescences* capitate and consisting of a single terminal involucre with the head 1–1.5 cm across to biumbellate and up to 4 cm high and across, the branches thinly tomentose; *bracts* 3–5 at the base of the involucre and at each node, usually with 1–3 semifoliaceous ones with one distinctly longer than the others, 2–4 mm long and similar to the basal leaves only more reduced, the others reduced and scale-like, 0.7–1.5 mm long, all connate at the base; *peduncles* lacking; *involucres* solitary, campanulate, 3–3.5 mm long, 3.5–4 mm wide, thinly tomentose without, glabrous within, the 5–6 rounded shallow teeth less than 0.5 mm long, the bractlets small and peg-like, 0.8–1 mm long, densely hirsutulous, the pedicels numerous, 3–4 mm long, glabrous; *flowers* stipitate, pinkish-white with greenish to pinkish midribs and bases at anthesis, becoming pinkish in fruit, 4.5–6 mm long including the 1–1.3 mm long stipe, densely pubescent without especially along the midribs and stipe, glabrous within except for a few scattered minute glands, the tepals dissimilar, united about ¼ the length of the flower, the outer whorl oblong, 3–3.5 mm long, 0.9–1.2 mm wide, becoming turned outward in fruit, the inner whorl spathulate, 4–5 mm long, 1.8–2.5 mm wide, remaining erect, the pubescence remaining rather dense from anthesis to fruit; *stamens* slightly exserted, 3–4 mm long, the filament thinly pilose basally, the anther dark red to purple, 0.5–0.8 mm long, oblong; *achenes* light brown, 4–4.5 mm long, the narrow base tapering to a long, sparsely pubescent, 3-angled beak.

MEXICO: Nuevo León: Along Mexico Highway 57, 15.5 mi S of San Roberto Junction, 2.3 mi N of El Refugio, 0.5 mi W of highway on a small raised ridge of gypsum, with *Isocoma gypsophila*, *Strotheria gypsophila*, *Frankenia margaritae*, and *Calylophus*, 5700 ft elevation, 19 Sep 1972, *Reveal & Hess 3147* (Holotype, US; 30 isotypes to be distributed from US).

Additional specimens examined: MEXICO: Nuevo León: 16 mi S of San Roberto Junction, 0.5 mi W of highway, 24 Oct 1970, *Turner & Crutchfield 6310* (TEX).

The Turner Buckwheat, *Eriogonum turneri*, is a member of the subgenus *Oligogonum* Nutt, a complex of some 30 species typified by *E. umbellatum* Torr. (Reveal, 1969). The new species closely approaches *E. jamesii* Benth. in DC. var. *undulatum* (Benth. in DC) Stokes ex Jones, found in mountains and foothills of northern Mexico northward into western Texas and southeastern Arizona.

The new species may be distinguished by its short narrow leaves [5–11(15) mm long and 4–5(6) mm wide versus 1–2 cm long and 0.5–1 cm wide for var. *undulatum*]; the short compact inflorescence (up to 4 cm long for *E. turneri* and up to 1.5 dm long for var. *undulatum*); and the generally smaller fruiting flowers (up to 6 mm long in the new species and up to 9 mm long in var. *undulatum*). *Eriogonum jamesii* occurs typically on sandy loam to

clayey soils but, so far as known, not on gypseous soils. Likewise, var. *undulatum* in Mexico is found mainly in high mountains in well drained soils mostly above 7000 ft elevation. In most places, var. *undulatum* forms small to rather large mats (the latter especially in arroyos and on gradual rocky slopes), with its large leaves being a conspicuous part of the plant as is the tall (up to 5 dm) habit of the flowering stems and inflorescence. In *E. turneri*, the plants form very small compact mats, usually less than 2 dm across, on exposed valley bottoms at 5700 ft elevation. The plants, with their small inconspicuous leaves, rarely exceed 1 dm in height. Both entities have crispate leaf-margins, unlike var. *jamesii*.

It is a pleasure to name this species for Billie L. Turner, a Texan whose stature in plant taxonomy far exceeds that of this diminutive taxon. Field work was supported by NSF grant GB-22645.

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STUDIES IN AMERICAN RUBIACEAE
2. AYUQUE, BALMEA STORMAE, AN ENDANGERED MEXICAN SPECIES[1]

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It is difficult to establish the status of a continental tropical plant species as endangered, since the ranges of most of them are so inadequately known. The rubiaceous tree *Balmea stormae*, locally called *ayuque*, may conceivably be commoner than suspected in parts of Mexico as yet unstudied by botanists. However, one circumstance makes it likely that this species will soon become very rare in any place where it may be discovered. Due to its conical habit with pointed top when young, it is commonly cut and sold in markets in the Uruápan area as a Christmas tree. According to Miss Marian Storm, of Guadalajara, this use of *Balmea* arose when laws were enforced making it illegal to cut conifer saplings for this purpose.

Miss Storm, noted writer and poet who brought *ayuque* to the attention of Professor Maximino Martínez and for whom he named it, has, in a series of letters between the years 1965 and 1971, described the gradual disappearance of this plant from the *pedregales* or lava beds near Uruápan where she discovered it in 1941. There is an amusing account of *ayuque* and her adventures in bringing it to botanical notice in her charming book *Enjoying Uruápan* (1945; pp. 452-459) and a poem about it in her *Poems of Sun and Snow* (1955; p. 36).

It seems worthwhile to offer an account of the present status and knowledge of *Balmea stormae*, with the hope that Mexico, with its growing interest in conserving its natural resources, may afford this fine potential ornamental tree enough protection to enable it to survive and continue its role as a thing of beauty. Attempts are being made to bring it into cultivation. It might do well in warm temperate and subtropical rather dry regions.

Balmea, a monotypic genus of the *Cinchona* tribe of the Rubiaceae, is endemic to a few small areas in southern Mexico and Guatemala. It was first brought to the attention of the botanical public by Miss Storm although it had been collected as early as 1935 by George Hinton and had been given a manuscript name (as a *Randia*) on the basis of a 1939 Leavenworth and Hoogstràal collection sent to Paul C. Standley.

BALMEA Martínez, Bull. Torrey Bot. Club 69: 438-441, 1942; An. Inst. Biol. 13(1): 36-41, 1942.

This genus belongs to the group in Cinchonae characterized by the corolla contorted in bud, the circumscissile caducous calyx, and the elevated epi-

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[1] The first article of this series was published in SIDA 2: 386-389. 1966.

gynous disk in fruit. In habit *Balmea* is a tree, pyramidal or conic when young, irregular when older, with broad, cordate leaves, slender, usually several-times trichotomous cymes, and seeds with a wing surrounding the body and tapering at both ends. Its closest relative, *Cosmibuena*, has elongate, often bifid wings at each end of the seed. *Hillia*, likewise close, has a small wing at one end of the seed and a small tuft of hair at the other.

These seed differences are about the only tangible ones among the three genera. Otherwise *Balmea* is set off by a series of characters, any one of which would be regarded by itself as of scarcely specific importance. It differs essentially from *Hillia* only in its non-comose seeds (simply winged basally and apically, as in *Cinchona*, rather than with a conspicuous coma apically) and more superficially in its thinner much broader leaves with long sharply distinct petioles and in its pendent, usually much more complex inflorescences, those in *Hillia* being of 1 (often sessile) to 3 flowers. From *Cosmibuena*, *Balmea* differs in its pendent, more complex inflorescence, its red rather than white flowers, its broad, cordate, much more veiny leaves, and its never bifid seed wing.

In actuality the three genera could best be treated as one. I am deferring this reduction until all species of the three can be placed side-by-side to be certain that no significant breaks among them exist.

Martínez relates his genus also to *Blepharidium* Standl. This differs from the genera mentioned above in the aestivation of the four corolla lobes in bud, these being conspicuously overlapping but not contorted. The leaf venation is more pinnate with many more veins on a side. It is in this general affinity but related also to *Hintonia* and several other genera. On both ends the seeds have wings that are broadly obtuse or rounded and erose or tridentate at the tips.

BALMEA STORMAE Martínez, 1. c., figs. 1-6; 1. c., figs. 1-4.

Small tree or shrub 4–10 m, entirely glabrous, bark thin, wood fine grained, pale pinkish-cream; leaves suborbicular, somewhat broader distally, acuminate at apex, cordate to subcordate at base, with 4-6 principal veins of unequal strength on a side, these subopposite to alternate, more prominent beneath, blades up to 9 × 14 cm, 2–3.5 cm long, apparently leafless at time of fruiting (*McVaugh 22704*); stipules early caducous; cymes terminal, pendent, once to usually twice (rarely 3 times) trichotomous, often with 1–2 extra flowers at basal ramification, peduncle 3–7 cm long, caducous subulate bracts at ramifications, branches 1–2 cm long, pedicels 1–3.5 cm long, elongating and becoming recurved in fruit; flowers becoming very fragrant at night; calyx lobes 5, subequal or somewhat unequal, lanceolate, to 7–8 mm long, blunt, calyx caducous shortly after anthesis; corolla deep red to dark maroon, tubular, somewhat dilated distally, with 5 short recurved oval obtuse lobes, tube 20 to rarely 27 mm long, 5 mm wide at summit, on type collection notably marked with short white lines, lobes to 5 × 7 mm; anthers included, 5(–7), dorsifixed just below mouth of tube, broadly linear, divided at base; style 22–23 mm long, stigma somewhat enlarged, bifid, the blunt

lobes stigmatic on inside, disk (after corolla and other flower parts are shed), strongly elevated, conic, tipped with a short truncate style remnant, capsule oblong, 22–30 mm long, firm, dehiscing first septicidally, to the full length, then the disk loculicidally, the valves diverging somewhat, placentae lanceolate, fleshy, attached to septum, seeds reddish-tan, prominently winged, broadly lanceolate, (3)4–6 mm long, margins somewhat erose, one end narrowly acuminate, cellular reticulate, the other broader, acute to obtuse, cells arranged in a fan-like pattern, body of seed elliptic, 2 mm long.

The specific epithet has been spelled several ways, but the simple feminine ending used above was the way it was published originally. The English and Spanish versions of the original description were published almost simultaneously; I do not know which was first. The same ending was used in both publications.

Specimens examined: MEXICO. Temascaltepec: Nanchititla, 19 Jun 1935, *Hinton 7894* (US, 2 sheets, F); Michoacán: Palo Verde, near Uruápan, Sep 1941, *Storm* (US); Palo Verde, Pedregales de Jicalán, near Uruápan, summer 1941, *Storm* (US); Palo Verde, Pedregales de Jicatlán et San Pedro, near Uruápan, *Martínez 3400* (US); Palo Verde, near Uruápan, 20 (or 21) Sep 1941, *Martínez 3400* (MEXU; type, 2 sheets marked "tipo," one selected and marked "lectotype" by F. R. Fosberg, 1972, because it is somewhat more complete; US, 2 sheets; F); same locality, *Martínez s. n.* (F, 2 sheets without original labels, but marked "Isotype" and, on Field Museum label, "México, M. Martínez, Rec. Jan. 1944," probably duplicates of the type); Jicalán (as Jicatlán), near Uruápan, *Martínez 3400* (MEXU, 4 sheets; several gatherings made on different days were all numbered 3400); La Laguna entrada al cañon del Mal País, 15 Sep 1961, *Alonso & Ramírez* (MEXU), also 1961, *Ramírez & Alonso* (MEXU); N.W. Aguililla, 6–7 km S of Aserradero Dos Aguas, 2000 m, 3 Mar 1965, *McVaugh 22704* (ENCB) (fruiting twigs without leaves, both fruits and seeds longer than on type); 2 mi S of Uruápan, 5577 ft, 29 Jul 1941, *Leavenworth & Hoogstraal 1229* (F).

GUATEMALA. Dept. Huehuetenango: NW of Cuilco, 2/3 way up Cerro Chiquihui above Carrizal, tree 25 ft tall, 1350-2300 m, 17 Aug 1942, *Steyermark 50811* (US, F) (sterile but has the right leaves); Dept. Jalapa: Potrero Carrillo, 14 mi NE of Jalapa, 1500-1900 m, 11 Dec 1939 *Steyermark 33056* (US, F) (Epiphyte with branches fleshy, leaves not or scarcely cordate on US sheet, cordate and normal for species on F sheet; stipules ovate); Dept. Zacapa: San Lorenzo, Sierra de las Minas, shrub 10 ft tall, 1600 m, 24 Jan 1942, *Steyermark 43177* (F).

HERBARIUM AND FIELD STUDIES OF KENTUCKY PLANTS II. NEW STATE RECORDS AND RARITIES[1]

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This paper records several species that are apparently new to Kentucky or else are extremely rare in the state. Specimens in the combined Gray Herbarium - Arnold Arboretum Herbarium, the New York Botanical Garden Herbarium, and the United States National Herbarium were examined. I express appreciation to the curatorial staffs of these institutions. Collection numbers of most collections cited are those of the writer and his wife, here abbreviated EMB & ETB. Specimens are deposited in the Memphis State University Herbarium unless otherwise indicated, and duplicates are being distributed elsewhere.

Cyperus rotundus L. This is a serious weed farther south. Although the species has been established in Kentucky for some time, this is apparently only the second report. Gunn (1968) listed *C. rotundus* for the area included in his eight-county survey but did not indicate a more specific locality. According to Mr. D. C. Byers of Monticello, Kentucky, the species was introduced there with strawberry plants from Alabama in 1961, and it is now all over Wayne Co., carried about in soil on cultivators. Collection data: vegetable garden, 212 S. Main, Monticello, Wayne Co., 20 May 1966, *EMB & ETB 11833* (with John Warden).

Wolffia papulifera C. H. Thompson. This small aquatic monocot is previously unreported for the state; I found no Kentucky specimens in the herbaria examined. Gentry (1963), in an unpublished thesis, suspected that this and *Lapsana communis* L. (see below) were new state records. *Wolffia papulifera* periodically occurs in great numbers on the surface of ponds. Collection data: duck ponds, Lexington Cemetery, Lexington, Fayette Co., 17 Oct 1965, *EMB & ETB 11590.3*; N side of Lecompte's Bottom in lake along Kentucky River, Henry Co., 20 Oct 1962, *J. L. Gentry, Jr. 846.*

Chaenomeles speciosa (Sweet) Nakai (*Chaenomeles lagenaria* of auth., not (Loisel.) Koidz.) This, collected as an escape, has not been previously reported from Kentucky. I have seen no specimens from any of the surrounding states although Sharp (1960) reports *Cydonia japonica* Pers. as persistent in Tennessee, and this may be a synonym. Collection data: open mesophytic woods and clearings on river flood plain just N of jct. Ky. 986 at bridge over Little Sandy River, Rosedale, Carter Co., 23 May 1965, *EMB*

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[1] Contribution No. 5, Kentucky Flora Project, Memphis State University.

[2] Appreciation is expressed to the Faculty Research Committee, Memphis State University, for providing funds to enable me to visit the herbaria mentioned in this paper.

& *ETB 10173*; 0.6 mi E of jct. Ky. 174 and US 60, between highway and C. & O. RR tracks, Rowan Co., 23 Apr 1966, *EMB & ETB 11680.*

Arachis hypogaea L. This species is not grown commercially in Kentucky, and it is seldom cultivated in gardens. There are neither reports in the literature nor records in the herbaria of its occurrence in the state (the *Arachis* specimens in US were out when I checked there). It is doubtful that *A. hypogaea* would survive winter conditions in Kentucky or much farther north. We collected *A. hypogaea* at a garbage dump, which we revisited ten years later to observe if the species had survived there. No trace of it was found. Considerable disturbance was evident—fire, flooding, clearing, and cultivation. Any one of these could well account for its absence as well as that of many of the native species originally there. Collection data: garbage dump, E end of US 62 bridge over Green River, Ohio Co., 8 Jul 1962, *EMB & ETB 5766* (KY).

Erodium cicutarium (L.) L'Her. This species is apparently spread as an agricultural contaminant in fertilizers and/or feed: its habitat indicates dissemination of this type. It might be expected to occur in Kentucky based on the range given in Gleason and Cronquist (1963): " . . . throughout most of the U. S." Unfortunately, folders 2 - 7 were out when the NY collections were checked, and so positive confirmation of *E. cicutarium* as a species new to Kentucky must rest primarily on the literature. Collection data: off Cooper Drive along roadside by University of Kentucky Herbicide Building, Lexington, Fayette Co., 27 Apr 1965, *Bruce W. Mook 70*; in field, Agricultural Experiment Station Main Farm, University of Kentucky campus near Horticulture Herbicide House, Lexington, Fayette Co., 26 Apr 1965, *Frank Melton s.n.* (KY).

Euonymus kiautschovica Loes. Common in cultivation in areas of dense population. Seeds are spread by birds, and the species is a frequent escape. Some may identify this as *E. Fortunei* (Turcz.) Hand.-Mazz., a *prostrate*, *evergreen* species; *E. kiautschovica* is tardily *deciduous* and *upright* unless growing against a tree or wall in which case it becomes attached by adventitious roots (Rehder, 1940). Young *E. kiautschovica* may be somewhat trailing and evergreen, but older plants become almost devoid of leaves by the end of winter. The species grows against almost every tree on the University of Kentucky campus. Collection data: plants established under shrubs and in fence rows from seed scattered by birds (no cultivated plants of this species are known to grow in the near vicinity), 1234 Kastle Rd., Lexington, Fayette Co., 19 Mar 1966, *EMB & ETB 11634.*

Hedera helix L. This is a relatively infrequently cultivated ornamental in central Kentucky, where it is near its northern limit. There are no Kentucky specimens in the herbaria visited. Only Gunn (1968) and Duncan (1967) previously listed this species as an escape in Kentucky. Duncan's report is based on the collection cited. Collection data: roadsides and C. & O. RR right-of-way 6 mi E of jct. Ky. 182 and US 60, Aden Springs, Carter Co., 23 Apr 1966, *EMB & ETB 11713.*

Chaenorrhinum minus (L.) Lange. Reported previously only by Gunn (1968). This species may be much more widespread and abundant than his and my reports indicate since it is usually small and easily overlooked. Collection data: 2.1 mi S of bridge over Hinkston Creek, roadside between highway (US 68) and L. & N. RR tracks, Millersburg, Bourbon Co., 29 Jun 1966, *EMB & ETB 12139.*

Artemisia ludoviciana Nutt. This species, an old, widely-grown ornamental, may not be native to Kentucky. In both places where its varieties were collected, the plants had obviously spread from cultivation—which may be expected to occur more frequently near homes now abandoned due to adverse economic conditions especially in the Appalachian region. *Artemisia ludoviciana* var. *gnaphalodes* is listed by Gunn (1968), but there are no other literature references or specimens in the herbaria. Collection data: var. *ludoviciana*: growing wild on roadside at jct. Ky. 94 and Ky. 307, Hickman Co., 29 Jun 1962, *EMB & ETB 5636*, !Arthur Cronquist; var. *gnaphalodes* (Nutt.) T. & G.: Ky. 174 roadside, 1.6 mi W of Rowan-Carter Co. line, between highway and C. & O. RR tracks, Rowan Co., 15 May 1966, *EMB & ETB 11737.*

Lapsana communis L. This introduction is new to Kentucky. It might have been expected there, for Gleason and Cronquist (1963) stated " . . . now found throughout our range" and I saw collections from Indiana, West Virginia, and Virginia. Collection data: 1.3 mi W of jct. Ky. 389 and Ky. 202, hillside, edge of deciduous woods and grown-up field, Drennon Chapel, Henry Co., 3 Aug 1962, *J. L. Gentry, Jr. 607.*

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STUDIES OF THE SOUTHEASTERN UNITED STATES FLORA. IV. OLEACEAE[1]

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The Oleaceae is represented in our area by eight genera, four of which were introduced as ornamentals and have since become established to varying degrees in our flora.

In providing the treatment of the Oleaceae for the Southeastern Flora Project, a number of taxonomic decisions had to be made which demand some explanation prior to publication of the manual.

The treatment of the Oleaceae for the "Generic Flora of the Southeastern United States" (Wilson and Wood, 1959) should be consulted for a thorough description and discussion of the family, genera, and relationships.

The distribution of species is based on the specimens seen at A, DUKE, FLAS, GH, NCU, NSC, SMU, and US. It is imperative for anyone working on plants of the southeast to see—as a bare minimum—the specimens of A, GH, NCU, SMU, and US.

Key to Genera

1. Leaves pinnately compound, or reduced to one leaflet with an articulated petiolule; fruit a samara or 2-lobed berry.
   2. Trees or large shrubs; flowers apetalous; fruit a samara; leaves usually pinnate (Tribe Fraxineae) . . . . . I. FRAXINUS.
   2. Shrubs; flowers with showy corollas; fruit a 2-lobed berry; leaves pinnate or reduced to one leaflet (Tribe Jasmineae) . . II. JASMINUM.
1. Leaves simple or occasionally ternate in No. III; fruit a capsule, drupe, or drupe-like unlobed berry.
   3. Flowers yellow, appearing before the leaves (Tribe Forsythieae) . . . . . III. FORSYTHIA.
   3. Flowers white, lavendar to purplish, or apetalous, appearing before or with the leaves.
      4. Fruit a loculicidal capsule; flowers lavender to purplish or rarely white (Tribe Syringeae) . . . . . IV. SYRINGA.

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[1] Taken from a manuscript and notes compiled for the *Vascular Flora of the Southeastern United States*. The area covered in this treatment is bounded by and includes Delaware, Maryland, West Virginia, Kentucky, Arkansas, and Louisiana. The format follows Radford et al. (1967) except for punctuation. Any needed modifications or suggestions should be sent to me as soon as possible so that corrections can be made before the manual is in press. The first three parts of this numbered series with the same title are in the Journal Elisha Mitchell Sci. Soc. 87 (1), 87 (2), and 88 (1).

Approved as Paper No. 4004 of the Journal Series, NCSU Agric. Exp. Station.

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4. Fruit a drupe or berry; flowers white or apetalous (Tribe Oleeae).
   5. Corolla absent; flowers in scaly, short, lateral racemes or cymes; calyx minute or lacking . . . . . V. FORESTIERA.
   5. Corolla present; flowers in panicles; calyx present.
      6. Petals linear, united at base only; young inflorescence spreading or drooping . . . . . VI. CHIONANTHUS.
      6. Petal lobes broad and short above a distinct funnelform tube; young inflorescence erect or merely spreading.
         7. Inflorescence a few-flowered axillary panicle; leaves evergreen; drupe unilocular . . . . . VII. OSMANTHUS.
         7. Inflorescence a many-flowered terminal panicle; leaves deciduous or evergreen; drupe-like berry 2-locular . . . . . VIII. LIGUSTRUM.

I. FRAXINUS L. Ash.

This genus of some 65 species is represented in the southeastern U. S. by six species. Their relationships are discussed by Wilson and Wood (1959) and indicated in the key.

The taxonomic treatment is a conservative one. The problematic complexes are in Subsection Melioides where there is both ecotypic and ecophenic variation, as well as hybridization. All the complexes are in need of further biosystematic studies.

1. Calyx deciduous or lacking; terminal bud scales foliose (Subsect. Fraxinus).
   2. Branchlets 4-angled; lateral leaflets petiolulate; flowers with small deciduous calyx . . . . . 1. *F. quadrangulata.*
   2. Branchlets terete; lateral leaflets sessile; flowers without calyx . . . . . 2. *F. nigra.*
1. Calyx present and persistent in fruit; terminal bud scales not foliose (Subsect. Melioides Endl.).
   3. Leaves papillose beneath; wing of samara terminal or only slightly decurrent along upper third of body . . . . . 3. *F. americana.*
   3. Leaves not papillose beneath; wing of samara decurrent to near middle of body or beyond.
      4. Body of samara flattened and winged to the base . 4. *F. caroliniana.*
      4. Body of samara terete or nearly so and winged to near the middle or slightly beyond.
         5. Petiolule of lower leaflets winged nearly to base; samara wing usually less than 7 mm. wide, and body less than 2 mm. wide . . . . . 5. *F. pennsylvanica.*
         5. Petiolule of lower leaflets wingless; samara wing more than 7 mm. wide, and body more than 2 mm. wide . . . . 6. *F. profunda.*

1. *F. quadrangulata* Michx., Blue Ash.

Dry or moist rich woods; var. prov., chiefly IP, Ala., Ark., Ga., Ky., Tenn.,

W.Va. (Okla., Mo., Ill., Ind., Ohio).

The distribution of Blue ash is spotty and in a number of physiographic provinces. See Little (1971, map 128-E) for details.

2. *F. nigra* Marsh., Black Ash.

Wet woods, stream banks, bogs or swamps; pied. Del., Va., mts. Md., W.Va. (Ill., Ind., Ohio, Penn., N.J.).

Gleason and Cronquist (1963) record this species for Ky. No specimens have been seen to verify this record and neither Little (1971) nor Meijer (1971) include it for the state.

A chromosome count is needed for this species.

3. *F. americana* L., White Ash.

Rich upland woods, dry slopes, well-drained flat woods; all prov. SE (ALL).

Incl. *F. biltmoreana* Beadle, *F. catawbiensis* Ashe—S; incl. *F. a.* var. *biltmoreana* (Beadle) J. Wright ex Fern—F, R; incl. *F. a.* var. *microcarpa* Gray—F.

Although all provinces are represented, White ash is absent from most of the lower woods of the Atlantic and Gulf Coastal Plain and Mississippi embayment. See Little (1971, map 126-E) for details.

This is one of the extremely polymorphic species, or species complexes, involving ecotypic (Wright, 1944a) and ecophenic variation, three ploidy levels ($2n=46$, 92, 148), plus hybridization (Miller, 1955). The Biltmore ash has frequently been distinguished as a species or variety by various authors. Although the extremes, involving a number of characteristics seem clear enough, there is neither a real morphological discontinuity between them, nor a clear ecological or geographical separation. In some areas, such as Mississippi, Biltmore ash occurs in acid soil while White ash is a calciphile, but this does not seem to hold up elsewhere. One interpretation (Miller, 1955) is that the Biltmore ash represents a hybrid between *F. americana* and *F. pennsylvanica*. This needs a thorough investigation, although substantiated by the work of Santamour (1962). Variety *microcarpa* Gray seems to be a small-fruited form that appears randomly through the population. The type named by Ashe as *F. catawbiensis* from the piedmont of Georgia and the Carolinas seems to be a pubescent form with some characteristics reminding one of either *F. caroliniana* on one hand or *F. profunda* on another. This needs critical study.

Until the pattern and origin of the variation and presence of any real discontinuities are known more exactly than now, I prefer to think of White ash as one polymorphic species without segregate species or varieties. See also Little (1952) for a discussion of varieties.

4. *F. caroliniana* Mill., Water Ash, Pop A., Carolina A.

Low woods, river bottoms, cypress heads, swamps, hammocks; chiefly cp., Ala., Ark., Fla., Ga., La., Miss., N.C., S.C., Va. (Tex.)

Incl. *F. pauciflora* Nutt.—S; incl. *F. c.* var. *oblanceolata* (Curtis) Fern. & Schub., *F. c.* var. *cubensis* (Griseb.) Lingelsh.—F.

As indicated by the synonymy above and the additional names given by

Little (1952, 1953), this is an extremely variable species. In fact, Fernald (1950) considered it "our most variable species [of ash]" and recognized three varieties each with two forms. The variation involves the shape and size of samaras, and pubescence of petiole, rachis, and leaflet. As with White ash, the variation seems fairly random without any real morphological-ecological-geographical types that should be considered distinct at any level.

5. *F. pennsylvanica* Marsh., Green Ash, Red A.

Moist or wet alluvial soils, river and stream margins, swamps; all prov. SE except penin. Fla. (ALL).

Incl. *F. darlingtonii* Britt., *F. smallii* Britt.—S; incl. *F. p.* var. *subintegerrima* (Vahl.) Fern.—F, R.

A detailed distribution map is given by Little (1971, map 130-E).

The variability in this species is seen in the pubescence, shape and texture of the leaflets, and shape and size of the samaras. Three ecotypes have been distinguished by Wright (1944b). Again there appears to be no real discontinuity between any of the forms. The glabrous variety *subintegerrima* is recognized by a number of authors but it grows with var. *pennsylvanica* and there is apparently no barrier to interbreeding. I view the variation in pubescence in this species as similar to that in White ash, thus for the sake of consistency, I am not recognizing varieties.

The common names are somewhat confused. When the more common and widespread glabrous var. *subintegerrima* was recognized, it was called Green ash, and the pubescent var. *pennsylvanica* was called Red ash. When the two varieties are not distinguished, Green ash is the preferred common name and the one used by the U. S. Forest Service (Little, 1953).

6. *F. profunda* (Bush) Bush, Pumpkin Ash.

Swamps and river bottoms; chiefly cp., SE except Del., Ky., W.Va., (Mo., Ill., Ind., Ohio).

Incl. *F. michauxii* Britt.—S; *F. tomentosa* Michx. f.—R, G, F.

The Pumpkin ash is possibly either an autopolyploid of *F. pennsylvanica* or an allopolyploid (hexaploid $n=69$) derivative of *F. americana* ($n=46$) $\times$ *pennsylvanica* ($n=23$). Wright (1944b, 1957, 1965) and Miller (1955) discuss this further. This needs a thorough investigation.

The name of this species has been shifted back and forth between *F. profunda* and *F. tomentosa* for a number of years. According to Little (1952), *F. tomentosa* must be rejected as nomenclaturally superfluous when published. This represents another nomenclatural change not too unlike *Betula lutea* to *B. alleghaniensis* (Hardin, 1971).

II. JASMINUM L. Jasmine.

It is extremely frustrating to deal with the taxonomy and nomenclature of those groups that are only naturalized in the Southeast. There is no easy way to gain a real concept of the species and be certain of the correct nomenclature. It is also very difficult to tell from herbarium specimens which species are really naturalized and not just escaped or persistent from cultiva-

tion. Collectors should note this distinction on the label.

In this treatment of the Oleaceae, the Jasmines, Forsythias, and Ligustrums have to receive a tentative treatment heavily dependent upon the available literature.

Some of the nomenclature in Wilson and Wood (1959) and other authors apparently is incorrect according to Read (1962). Long and Lakela (1971) follow Read in naming the Florida plants, and I will do likewise here for those naturalized in the Southeast.

1. Corolla yellow . . . . . 1. *J. mesnyi.*
1. Corolla white or pink tinged.
  2. Leaves of 3–7 leaflets.
    3. Leaflets 3; calyx very short compared with corolla tube . . . . . 2. *J. fluminense.*
    3. Leaflets 5–7; calyx half or as long as corolla tube . . 3. *J. officinale.*
  2. Leaves 1-foliolate (apparently simple).
    4. Calyx glabrous or nearly so, the lobes less than 3 mm. long . . . . . 4. *J. dichotomum.*
    4. Calyx pubescent, the lobes 4–12 mm. long.
      5. Calyx lobes densely pubescent . . . . . 5. *J. multiflorum.*
      5. Calyx lobes hirsute on the edges or pilose.
        6. Calyx lobes mostly 7–12; stems puberulent; leaves with tufts of pale hairs in axils of veins beneath . . . . . 6. *J. sambac.*
        6. Calyx lobes 5–7; stems glabrous; leaves glabrous beneath . . . . . 7. *J. nitidum.*

1. *J. mesnyi* Hance, Primrose Jasmine.

Edges of woods, creek banks; cp. Fla., Ga. (Tex.).

This species is a native of western China. It is not commonly grown and hence rarely found escaped or naturalized.

2. *J. fluminense* Vellozo, Azores Jasmine, Climbing J.

Weedy in waste places and old fields; cp. s. Fla.

Incorrectly called *J. azoricum* L. (Read, 1962), it is a native of Brazil.

3. *J. officinale* L., Poet's Jasmine, Common J.

Pinelands and thickets, waste places; cp. s. Fla.

Incl. *J. grandiflorum* L.—S.

This is a native of India and China and is the hardiest of the white-flowered Jasmines. The large flowered form represented by nearly all our materials, is known in the trade as var. *grandiflorum* (L.) Bailey (forma *grandiflorum* (L.) Kobuski). I prefer not to recognize these cultivars formally.

4. *J. dichotomum* Vahl, Gold Coast Jasmine.

Vacant lots, roadsides, hammocks; cp. s. Fla.

As implied by the common name, this is a native of Ghana and the west coast of Africa.

5. *J. multiflorum* (Burm. F.) Andr., Furry Jasmine, Downy J. Waste places,

cp. s. Fla.

This species has been found naturalized in Highlands Co. Fla. It is a native of India and southeastern Asia.

6. *J. sambac* (L.) Solander in Ait., Arabian Jasmine.

Hammocks, woods, and thickets; cp. s. Fla.

Naturalized from tropical Asia.

7. *J. nitidum* Skan

Hammocks, disturbed sites; cp. s. Fla.

Erroneously known as *J. amplexicaule* Wall. ex Don; or *J. undulatum* Ker.—S.

Naturalized from the Admiralty Islands.

III. FORSYTHIA Vahl, Forsythia, Golden Bells.

Forsythia has not been considered heretofore as part of the Southeastern Flora. It was not included by either Small (1933) or Wilson and Wood (1959). Although it is a very commonly cultivated ornamental shrub, and may persist about old dwellings, it seldom becomes established or naturalized. One of the possible reasons for the lack of establishment and few seeds is its heterostylous nature. If the shrubs are self-incompatible, and both of the distylic forms are not close enough for cross-pollination, there would be no seeds produced. This hypothesis needs verification.

As indicated under *Jasminum*, it is difficult to determine naturalization by information on herbarium sheets. There are a number of records, however, of local establishment of the two species included here. It appears that we have to include the Forsythias as part of the Flora.

1. Mature branches with hollow or irregularly excavated pith between the nodes; leaves oblong-ovate; branches generally arching or drooping . . . . . 1. *F. suspensa.*

1. Mature branches with chambered pith; leaves oblong-lanceolate; branches usually erect . . . . . 2. *F. viridissima.*

1. *F. suspensa* (Thunb.) Vahl.

Edge of woods, waste places; Va.

2. *F. viridissima* Lindl.

Edge of woods, creek banks, road sides and waste places; Ark., Md., N.C., Va. (Ill.).

IV. SYRINGA VULGARIS L., Common Lilac.

Waste places, fence rows, edge of woods; Md., Va. (Mo., N.J.).

This native of southeastern Europe persists from old plantings, and sparingly escapes in the cooler parts of our area. The Persian Lilac (*S. persica* L.) is frequently cultivated and escapes rarely but has not become established in our area as far as I know.

V. FORESTIERA Poir., Forestiera.

There is need for studies of ecophenic, ecotypic, and clinal variation and introgression as indicated by Wilson and Wood (1959). I am following Johnston (1957) here for the most part.

Shinners (1959) has determined *F. porulosa* as the correct type of the genus.

1. Leaves evergreen, margins entire . . . . . 1. *F. segregata.*
1. Leaves deciduous, margins serrate or minutely so.
   2. Plants flowering before the leaves expand; fruits slender, length 2 or more times the width . . . . . 2. *F. acuminata.*
   2. Plants flowering after the leaves have expanded; fruits broad, length less than twice the width . . . . . 3. *F. ligustrina.*

1. *F. segregata* (Jacq.) Krug & Urban, Florida Privet.

Two varieties, that may merely represent the extremes of an ecocline, have been recognized by Johnston (1957) and Long and Lakela (1971). See the discussion of the Florida Scrub at the end of this paper.

a. var. *segregata*

Coastal dunes, hammocks, mangrove swamps, river bottoms, low pinelands; cp., Ga., Fla.

Incl. *F. globularis* Small, *F. porulosa* (Michx.) Poir.—S.

b. var. *pinetorum* (Small) M. C. Johnston

High, dry pinelands; s. Fla.

F. pinetorum Small—S.

2. *F. acuminata* (Michx.) Poir., Swamp Privet.

Wet woods, swamps, river banks, hammocks; chiefly cp. Ala., Ark., Fla., Ga., Ky., La., Miss., S.C., Tenn. (Tex., Okla., Mo., Ill., Ind.).

3. *F. ligustrina* (Michx.) Poir.

Rocky soils, sandy stream banks, dunes, calcareous glades and uplands, granite flat rocks, swampy woods, and hammocks; chiefly cp. and adjacent provinces, Ala., Fla., Ga., Ky., La., Tenn. (Tex.).

F. pubescens Nutt.—sensu S, not Nutt.

VI. CHIONANTHUS L., Fringe-tree, Old-man's-beard.

Fringe-tree is variable in overall size, pubescence, leaf form, length of petals, stamen number, anther size, shape of anther tips, and fruit size. Some of the variants have been named as distinct species. For instance, Small (1924) recognized *C. pygmaeus*, a small shrub with small leathery leaves, blunt-tipped anthers, short petals, and large fruits, and an endemic of the sand-scrub in the lake region of south-central Florida. Li (1966) described *C. henryae*, a small shrub with small rather coriaceous leaves, prolonged anther tips, and fairly short petals, and which he said occurred in northwestern Florida, southern Arkansas, southern Alabama, and west-central Georgia. In addition, four varieties have been named on the basis

of leaf shape and pubescence.

It appears that forms with small anthers and small petals are scattered throughout the area although more frequent in dry habitats southward; the anther tips vary from rounded or very blunt to very prolonged acuminate with the blunt form mostly in south Florida. This variation needs to be thoroughly studied using fresh material and correlated with habitats and the sexuality of the flowers. At the present time, I prefer to recognize only two species. See the discussion of the Florida Scrub at the end of this paper.

1. Corolla lobes 1.5–3 cm. long; anther tips prolonged; drupe 1–1.5 cm. long . . . . . 1. *C. virginicus.*
1. Corolla lobes about 1 cm. long; anther tips blunt or acute; drupe 2–2.5 cm. long . . . . . 2. *C. pygmaeus.*

1. *C. virginicus* L.

Dry sandy woods, rocky slopes, savannahs, pocosins, swamps, rich woods; all prov. SE (Tex., Okla., Mo., Ohio, Pa., N.J.).

Incl. *C. henryae* Li; tentatively placed here on the basis of the long anther tips.

2. *C. pygmaeus* Small.

Pine scrub; s. penin. Fla.

VII. OSMANTHUS Lour., Devilwood, Wild Olive.

Devilwood is variable in leaf size, texture, and shape; fruit size, shape, and color; and inflorescence size, pubescence, and compactness. Most of the variation in and between populations is found in peninsular Florida. There is need of further study from the standpoint of the degree of isolation between the variants. See the discussion of the Florida Scrub at the end of this paper.

1. *O. americanus* (L.) Gray.

Two varieties are recognized following Green (1958).

a. var. *americanus.*

Hammocks, bays, low woods, swamps, maritime forests, rich woods; chiefly cp. Ala., Fla., Ga., La., Miss., N.C., S.C., Va. (Tex.).

Amarolea americana (L.) Small—S; incl. *O. floridana* Chapm.—S.

b. var. *megacarpus* (Small) P.S. Green.

Pine scrub; penin. Fla.

Amarolea megacarpa Small—S.

VIII. LIGUSTRUM L. Ligustrum, Privet.

The species of our area are all escapes from cultivation. They all could be more common and widespread than herbarium specimens indicate. Again, as with *Jasminum* and *Forsythia*, it is difficult to determine which are really naturalized in our area. Also, in this rather difficult genus, the taxonomy and nomenclature of our plants seem uncertain in a few cases. A revision of

the genus is needed.

1. Twigs pubescent.
   2. Corolla tube equalling or shorter than the lobes.
      3. Flowers sessile or subsessile . . . . . 1. *L. quihoui.*
      3. Flowers pedicellate.
         4. Twigs densely pubescent; leaves pubescent on midrib beneath . . . . . 2. *L. sinense.*
         4. Twigs minutely puberulent; leaves glabrous . . . 3. *L. vulgare.*
   2. Corolla tube slightly or to 3 times longer than lobes.
      5. Calyx and pedicels pubescent . . . . . 4. *L. obtusifolium.*
      5. Calyx and pedicels glabrous or slightly pubescent at base of calyx.
         6. Leaves 2–6 cm. long; twigs conspicuously pubescent . . . . . 5. *L. amurense.*
         6. Leaves 4–10 cm. long; twig minutely puberulent . 6. *L. japonicum.*
1. Twigs glabrous.
   7. Corolla tube equalling or shorter than lobes.
      8. Leaves persistent or tardily deciduous, 6–15 cm. long . 7. *L. lucidum.*
      8. Leaves deciduous, 3–6 cm. long . . . . . 3. *L. vulgare.*
   7. Corolla tube slightly or to 3 times longer than lobes.
      9. Leaves persistent and glossy, rounded or broadly cuneate at base; corolla tube slightly longer than lobes . . . . . 6. *L. japonicum.*
      2. Leaves deciduous or half evergreen, cuneate at base; corolla tube 3 times longer than lobes . . . . . 8. *L. ovalifolium.*

1. *L. quihoui* Carr., Wax-leafed Ligustrum.

Rare in low woods, waste places; cp. N.C., Va. (Tex.).

2. *L. sinense* Lour., Chinese Privet.

Low woods, fence rows, waste places; various prov. SE except Del. and W.Va. (Tex., Okla.). This is probably the most frequently and widely escaped and naturalized of the privets.

3. *L. vulgare* L., Common Privet.

Thickets, open woods, low woods; various prov. Ala., Ark., Ky., La., N.C., S.C., Tenn., W.Va. (Tex., Ill., Ind., Ohio, Penn., N.J.).

4. *L. obtusifolium* Sieb. & Zucc.

Thickets, edge of woods, roadsides; rarely established in Ky., Md., N.C. (Penn.).

5. *L. amurense* Carr., Amur Privet.

Thickets, open woods; rare, cp. and pied. N.C. and Va. (Tex.).

6. *L. japonicum* Thumb., Japanese Privet.

Low woods, infrequently established; cp. pied. Ala., N.C., S.C. (Tex.).

7. *L. lucidum* Ait., Wax-leafed Privet.

Low woods and thickets; cp. Ala., Ga., La., Miss. (Tex., Penn.).

8. *L. ovalifolium* Hassk., California Privet.

Hammocks, roadsides, thickets; infrequent in cp. and pied., Fla., Ky., Md., N.C. (Tex., Mo., Penn.).

SPECIES OF THE FLORIDA SCRUB

The distinctness of the "scrub" or "Florida scrub" has long been known and described (Nash, 1895; Harper, 1915, 1927; Mulvania, 1931; Kurz, 1942). These are areas of deep white to gray, fine sands on fairly recent or very ancient dunes, bars, or ridges. The vegetation is dominated by *Pinus clausa* and scrub oaks and a mosaic of shrub thickets and open white sand. It is an extreme habitat of low fertility, excessively drained deep sand, and high summer temperatures.

Davis (1967) shows the distribution of these scrub forests along the northwestern and eastern coasts, scattered small inland "islands" in the peninsula, and large areas in Marion, Lake, Volusia, Polk, and Highland counties.

The origin and distinctness of these habitats is important when considering the Oleaceae of the Southeast for *Chionanthus pygmaeus* and *Osmanthus americanus* var. *megacarpus* occur in the scrub.

Chionanthus pygmaeus is found in the scrub of Highlands, Hillsborough, and Polk counties. It seems to be fairly distinct as a small shrub with smaller leaves, smaller petals, blunt-tipped anthers, and larger drupes. *Chionanthus virginicus* occurs in more mesic or wet habitats and the two seem both geographically and ecologically isolated. It is for this reason that I am recognizing two species. The problem here is that individual characters appear to vary throughout the range of *Chionanthus* as indicated earlier. However, only in the south Florida scrub is there the correlation of the features characterizing *C. pygmaeus*. The more recently described *C. henryae* is somewhat similar to *C. pygmaeus* in morphology and habitat and, although disjunct from *C. pygmaeus, may* be related or reflect similar ecotypic differentiation. This needs further study.

Osmanthus americanus var. *megacarpus* is found in the scrub of Hernando, Highlands, Polk, Osceola, Sarasota, and Sumter counties. It is characterized by a smaller habit, often smaller leaves, and larger fruits. The typical var. *americanus* is widespread and in hammocks, bays, low woods, and swamps. Although ecologically allopatric, the two are geographically sympatric and probably not completely reproductively isolated. Intermediates do occur, and I prefer to use the varietal level for these extremes.

Forestiera segregata var. *pinetorum* does not occur in the typical scrub but is in the drier pinelands of Dade County. The extreme form is distinct with smaller leaves, puberulent stems, and smaller drupes. The typical var. *segregata* has larger leaves, glabrous stems, and larger fruits and occurs in more mesic habitats and is more widespread geographically. The two are geographically sympatric and probably not entirely isolated reproductively. Intermediates do occur and I think the varietal level is appropriate here.

It may seem inconsistent in this treatment of the Oleaceae to recognize these variants in the scrub or high pinelands on the one hand, and on the other not to formally recognize the tremendous variation in some of the ashes. My justification lies in the relative distinctiveness of the Florida scrub

vegetation. Until detailed biosystematic studies are made, I consider the differences in these plants to be more than mere ecotypes, for they seem relatively isolated from their counterparts in more mesic environments. In addition, they may have been isolated for a very long time since these habitats are considered ancient dunes or coastal bars or ridges.

The adaptations seem rather obvious. The smaller habit, smaller leaves, smaller petals, and pubescence are all probably adaptations to the severe dry conditions of potentially high transpiration rates and insufficient soil water. The larger drupes of *Chionanthus* and *Osmanthus* may reflect a selective pressure at the time of seedling establishment. The larger seeds with more stored food may have a better opportunity for more vigorous growth and are thereby able to establish a more extensive root system and escape dessication following germination. Another possible explanation, and a rather intriguing one, is that the larger drupes reflect differential selection by the Florida gopher, or Gopher tortoise (*Gopherus polyphemus*). This tortoise is common in these dry sandy habitats and are known to eat fleshy fruits. One could imagine their selection for larger drupes, and then possibly a higher germination rate among the seeds that pass through their bodies and germinate in a nitrogen-rich environment. Regardless of the particular selection mechanisms, these appear to be good examples of adaptive radiation and parallel evolution in related genera.

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NOTES

FATOUA VILLOSA (MORACEAE) IN FLORIDA.—*Fatoua villosa* (Thunb.) Nakai is a native of eastern Asia. Dr. John Thieret discovered it in Louisiana in 1964 (*Sida* 1: 248), the first time it was seen in America. I found the plant at Saint Leo College, Saint Leo, Pasco Co., Florida, growing in a thick patch as a pesty weed among a planting of zamias and bromeliads on our campus. Voucher specimens have been deposited in SMU and GH. I have some extra duplicates for distribution to individuals who request them.—*Damian DuQuesnay, Saint Leo College, Saint Leo, FL 33574.*

CAPERONIA PALUSTRIS (EUPHORBIACEAE) IN ARKANSAS.—*Caperonia palustris* (L.) St.-Hil., widespread in warmer parts of America, ranges along the Gulf Coast from Florida to Texas. Correll & Johnston (*Manual of the Vascular Plants of Texas*, 1970) date its introduction into Texas at about 1920. In July 1971 a scrap of plant material collected by a representative of the Arkansas State Plant Board was sent to me for identification. The specimen, from a rice field in east-central Arkansas, appeared to represent *C. palustris*. My student assistant, David Wheat, visited the rice field in September 1971 and collected a number of specimens of undoubted *C. palustris*. According to the owner of the land, the plants at that time had successfully resisted all attempts at eradication with herbicides. Specimens collected by Wheat have been distributed through the Southern Appalachian Botanical Club. Collection data: small population in rice field 11 mi N of Stuttgart, Prairie Co., 11 Sep 1971, *David Wheat s.n.*

Another Arkansas collection of the species was made in 1971 (UARK). Collection data: weed in soybean field near DeWitt, Arkansas Co., 6 Nov 1971, *H. R. Durst, s.n.*, Extension Agronomist, determined by E. B. Smith.—*G. E. Tucker, Arkansas Polytechnic College, Russellville, AR 72801.*

ALLIUM AMPELOPRASUM (LILIACEAE) AND TRIFOLIUM VESICULOSUM (LEGUMINOSAE) IN OKLAHOMA.—These species are new to the Oklahoma flora. *Allium ampeloprasum* L., found along a roadside, was associated with such native plants as *Polytaenia nuttallii, Monarda fistulosa, Cacalia plantaginea, Centaurea americana, Echinacea pallida, Engelmannia pinnatifida*, and *Silphium laciniatum*. According to a local resident, the "wild garlic" had been there for several years, each year becoming more abundant—in spite of the fact that he and others annually dug bulbs for culinary use. I counted 200 plants in a distance of 400 feet. They were producing many offsets. Collection data: roadside 6 mi NE of Madill, Marshall Co., 10 Jun 1973, *Thieret 41147* (KNK). *Trifolium vesiculosum* Savi, reported in 1969 from Louisiana and Mississippi as new to the United Sates and in 1970 as new to Alabama, was seen along roadsides in several places in Johnston County. It was conspicuous because of its relatively large heads. Collection data: roadside 0.5 mi N of Milburn, Johnston Co., 20 June 1973, *Thieret 41146* (KNK).—

John W. Thieret, Northern Kentucky State College, Highland Heights, KY 41076.

CORALLORHIZA ODONTORHIZA (ORCHIDACEAE) IN LOUISIANA—While working on a Flora of St. Helena Parish, Louisiana, I collected *Corallorhiza odontorhiza* (Willd.) Nutt., a new state record. This orchid was to be expected in Louisiana as it had been recorded from neighboring Mississippi and Arkansas (D. S. Correll, *Native Orchids of North America North of Mexico*, 1950; also *in litt.*). Louisiana's orchid flora is now 37 species, of which 19 occur in St. Helena Parish. Collection data: rich woods 5 mi NNW of Chipola, St. Helena Parish, 8 Oct 1971, *Allen 1691* (LAF, LSU).—*Charles M. Allen, University of Southwestern Louisiana, Lafayette, LA 70501.*

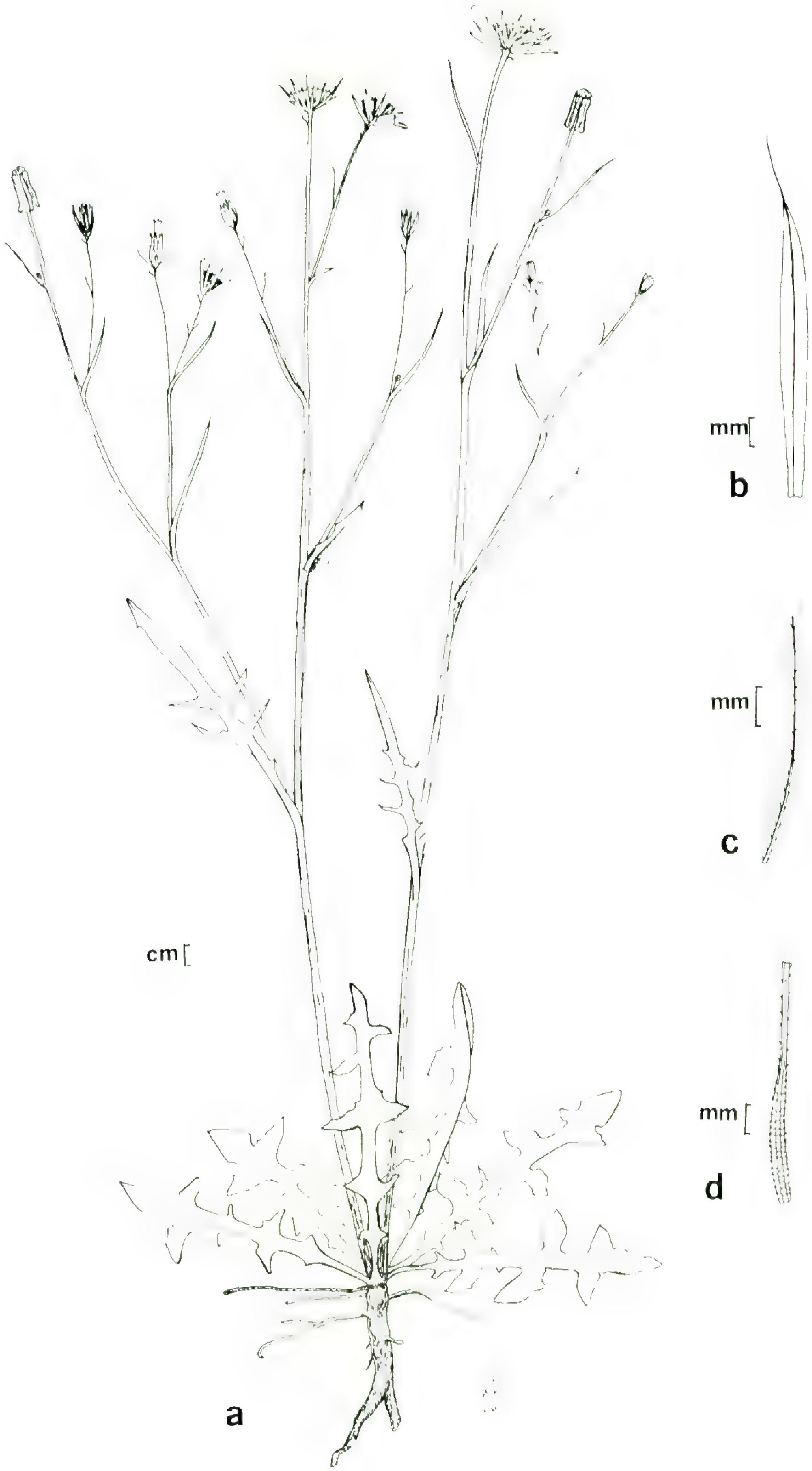
HYPOCHOERIS IN TEXAS.—Since the completion of the Manual of the Vascular Plants of Texas (Correll and Johnston, Texas Research Foundation, Renner. 1970) recent collections have extended the known range of *Hypochoeris microcephala* var. *albiflora* and added two species of the genus, *H. radicata* L. and *H. brasiliensis* (Less.) Benth. & Hook., to the flora of the state.

Hypochoeris microcephala var. *albiflora* (Figure 1) was first collected in North America by L. H. Shinners (Sida 2: 393-394. 1966). This taxon has become an abundant roadside weed in southeast Texas. In the last two years, it has replaced *Pyrrhopappus* as the most frequent Cichoriaceous taxon in some places along the freeway system and in vacant lots near and in Houston, Texas. In the springs of 1969 and 1970, I collected *Krigia* and *Pyrrhopappus* in Harris County at several localities, where var. *albiflora* is now abundant. It must have been extremely rare or absent prior to 1970 in these localities. I have seen the following specimens of var. *albiflora*:

LOUISIANA: Calcasieu Parish. Interstate 10 at Calcasieu River, 31 May 1969, *Thieret 30814* (LAF).

TEXAS: Jefferson Co. Port Arthur, 25 May 1969, *Knight 128* (TEX 2). According to Mr. Leonard Knight, this taxon appeared in ditches and along roadsides in Port Arthur in the early 1960's (Pers. comm.); Hardin Co. just N. of Kountze, 21 May 1970, *Correll & Correll 38813* (TEX); Harris Co., SW Houston, Stellalink Rd. and Linkwood Rd., vacant lot. 27 Mar 1972, *Tomb 724* (CHI, TEX); ca 5 mi N. of Houston city limits on Interstate 45, 7 April 1972, *Tomb 743* (SMU, TEX). Orange Co. 6 mi N. of Orange, 17 May 1966, *Shinners 31370* (SMU, TEX); Western edge of Vidor, 21 April 1970, *Flyr 1354* (SMU).

Hypochoeris microcephala var. *albiflora* is a well adapted, rhizomatous, perennial weed that occurs in both sand and heavy clay soils. Its small white heads and low pollen production per anther suggest that it is self-fertile.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The chromosome number of *H. microcephala* var. *albiflora*, $n = 4II$, is reported here for the first time (determined from *Tomb 743* and *724*). This number agrees with those reported for the other South American members of the genus.

In 1970, the Correll's made what appears to be the first collection of *Hypochoeris radicata* L. in Texas: Newton Co., 3 mi S. of Burkeville, sandy soil, edge of woods, 19 May 1970, *Correll & Correll 38775* (SMU, TEX). This European species is widespread over the eastern half of North America, the Pacific Northwest, and in Central America.

Another new record for Texas is *Hypochoeris braziliensis*: Anderson Co., SE edge of Palestine, growing in sandy soil, disturbed roadside, *Tomb 745* (SMU, TEX). This species is also from South America and is closely related to *H. microcephala*.

Hypochoeris radicata and *H. braziliensis* are presently known from Texas from single collections and should be carefully watched for expansion and migration. It is too late to accurately retrace the initial introduction, local migrations and expansion of *H. microcephala* var. *albiflora*, yet it should be watched for continued expansion from its present North American distribution. As Shinners (Sida 2: 119-128. 1965) said, we cannot continue to disregard weeds; they have much to tell us.—*A. Spencer Tomb, Department of Biological Sciences, University of Illinois at Chicago Circle, 60680*

Fig. 1. *Hypochoeris microcephala* var. *albiflora*. A. habit. B. palea from receptacle. C. pappus bristle. D. achene. *Correll* and *Correll 38813* except basal rosette and root from *Flyr 1354*. Drawings by Karen Baker.

DOCUMENTED PLANT CHROMOSOME NUMBERS 1974:1

CARL S. KEENER

Department of Biology, The Pennsylvania State University, University Park, Pennsylvania, 16802

CHENOPODIACEAE[a]

CHENOPODIUM ALBUM L. var. STEVENSII Aellen.[d] (Fig. 1.) 2n=54. WISC., Door Co.: *H. M. Clark s.n.* (WIS).

CHENOPODIUM AMBROSIOIDES L.[b,c] (Fig. 2.) 2n=32. CALIF., Ventura Co.: *Pollard 23 October 1969* (CAS).

CHENOPODIUM CALIFORNICUM S. Wats.[d] (Fig. 3.) 2n=18. CALIF., Los Angeles Co.: *R. F. Thorne 37524* (RSA).

CHENOPODIUM CARNOSULUM Moq. var. PATAGONICUM (Phil.) Wahl[d] (Fig. 4.) 2n=18. CALIF., San Luis Obispo Co.: *R. F. Hoover 9856* (PAC).

CHENOPODIUM GIGANTEUM Don.[c] (Fig. 5.) 2n=54. Original seed source of plants used in virus studies at The Pennsylvania State University obtained from Europe; voucher for the seed source used in this study in PAC.

CHENOPODIUM GIGANTOSPERMUM Aellen.[b] (Fig. 6.) 2n =36. PA., Clearfield Co.: *H. A. Wahl 8288 with W. A. Niering* (PAC).

CHENOPODIUM GLAUCUM L. var. GLAUCUM[b] (Fig. 7.) 2n=18. WISC. Lafayette Co.: *Palzkill 17* (WIS).

CHENOPODIUM HYBRIDUM L.[b] (Fig. 8.) 2n=18. SWEDEN: Malmö, Skane Province. Original seed source from Lund Botanical Museum (LD); voucher material in PAC.

CHENOPODIUM MACROCALYCIUM Aellen.[c] (Fig. 9.) 2n=36. VA., Northampton Co.: *H. E. Ahles 57612* (NCU).

CHENOPODIUM POLYSPERMUM L. var. OBTUSIFOLIUM Gaudin.[d] (Fig. 10.) 2n=18. SWEDEN: Malmö, Skane Province. Original seed source from Lund Botanical Museum (LD); voucher material in PAC.

CHENOPODIUM PUMILIO R. Br.[b] (Fig. 11.) 2n=16. ARK., Clark Co.: *Demaree 54131* (PAC).

CHENOPODIUM RUBRUM L. var. RUBRUM.[b] (Fig. 12.) 2n=36. SWEDEN: Malmö, Skane Province. Original seed source from Lund Botanical Museum (LD); voucher material in PAC.

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[a] All counts were made from root tips of seedlings raised from seed taken from the indicated voucher specimens unless otherwise stipulated.

[b] Taxon for which the same chromosome count has been published previously.

[c] Taxon for which a chromosome count differing from this one has been published previously.

[d] No chromosome number reported previously for this taxon.

SIDA 5(4): 290—291. 1974.

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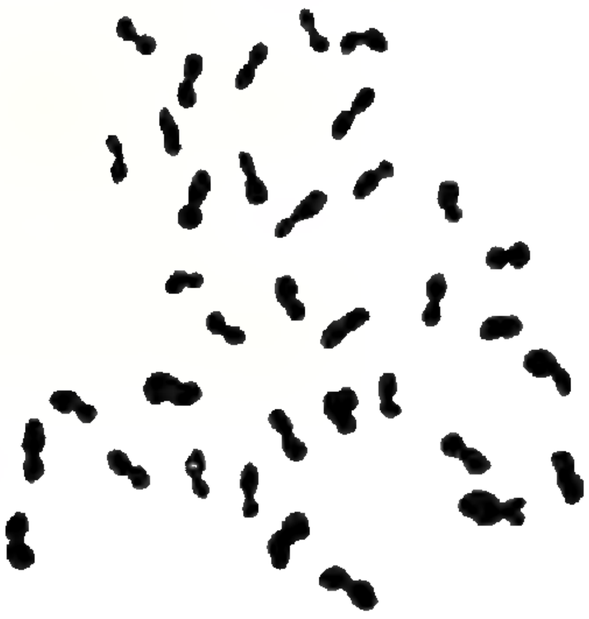

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DOCUMENTED PLANT CHROMOSOME NUMBERS 1974:2

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Department of Botany, The Ohio State University, Columbus, 43210

This work was supported by a grant from the Division of Basic Research of the College of Arts and Sciences, University of Wyoming.

In those instances where more than one population of a species were examined, material from the collection which is cited first is the one from which the drawings were made. Only those determinations which are new or which differ from previous reports are figured. All magnifications are ca. × 1250.

RANUNCULACEAE

ACONITUM COLUMBIANUM Nutt. ex T. & G. $2n = 16$. WYO., Albany Co., *Gardner 257* (RM); Carbon Co., *Crawford 656* (RM). These determinations agree with previous reports (Wiens and Halleck, 1962, Bot. Notiser 115: 455; Kawano, 1965, Bot. Mag. Tokyo 78: 361[1]).

ACONITUM COLUMBIANUM Nutt. ex T. & G. (Fig. 1) $2n = 18$. WYO., Teton Co., *Gardner 269* (RM). This determination represents the first report of this number in the species.

AQUILEGIA LARAMIENSIS A. Nelson (Fig. 2) $2n = 14$. WYO., Albany Co., *Gardner 223* (RM). This is the first report for the species, which is a rare endemic in the Laramie Range of southeastern Wyoming.

CLEMATIS LIGUSTICIFOLIA Nutt. ex T. & G. $2n = 16$. COLO., Larimer Co., *Gardner 230* (RM) and *Crawford 624* (RM). These reports agree with the two previous determinations for the species (Meurman and Therman, 1939, Cytologia 10: 1[1]; Kurita, 1956, Bot. Mag. Tokyo 69: 239[1]).

DELPHINIUM BARBEYI (Huth) Huth (Fig. 3) $2n = 16$. WYO., Carbon Co., *Gardner 265* (RM). This is the first report for the species.

DELPHINIUM GEYERI Green (Fig. 4) $2n = 16$. COLO., Larimer Co., *Crawford 623* (RM), and *Gardner 231* (RM); WYO., Laramie Co., *Gardner 239* (RM), Albany Co., *Gardner 242* (RM). These appear to represent the first determinations for this common plains larkspur.

DELPHINIUM NELSONII Greene $2n = 16$. WYO., Albany Co., *Gardner 225* (RM), and *Gardner 229* (RM). These determinations agree with previous

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[1] These reports were taken from Fedorov, 1969, Chromosome Numbers of Flowering Plants. Moscow: Acad. of Sciences of the USSR, V. L. Komarov Botanical Institute, 926 pp. The original papers have not been seen.

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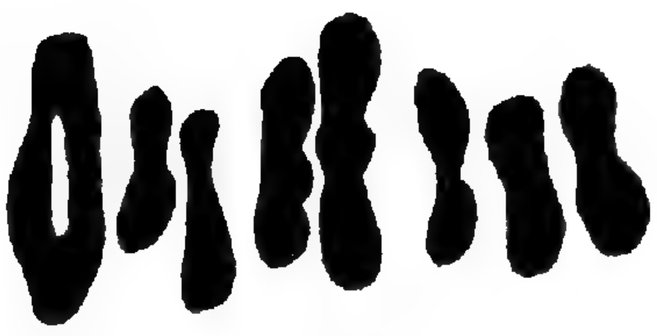

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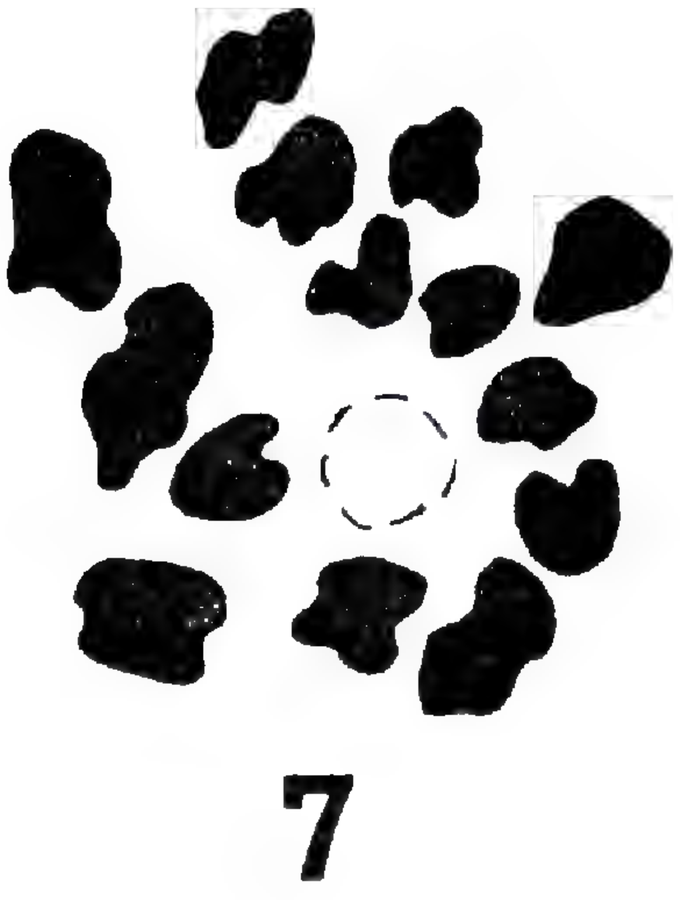

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reports for the species (Wiens and Halleck, 1962, Bot. Notiser 115: 455; Hartman and Crawford, 1971, Taxon 20: 158).

DELPHINIUM OCCIDENTALE (S. Wats.) S. Wats. (Fig. 5) $2n = 16$. WYO., Carbon Co., *Crawford 641* (RM) and *Gardner 263* (RM); Teton Co., *Gardner 267* (RM). These are first reports for the species.

DELPHINIUM RAMOSUM Rydb. (Fig. 6) $2n = 16$. COLO., Las Animas Co., *Crawford 677* (RM). This represents the first determination for this taxon.

RANUNCULUS ACRIFORMIS A. Gray (Fig. 7) $2n = 28$. WYO., Albany Co., *Crawford 639* (RM) and *Gardner 240* (RM); COLO., Larimer Co., *Gardner*

236 (RM). These reports apparently represent the first for the species.

RANUNCULUS ALISMAEFOLIUS Geyer ex Benth. var. MONTANUS S. Wats. $2n = 16$. WYO., Carbon Co., *Gardner 250* (RM); Albany Co., *Crawford 635* (RM). The present determinations are in agreement with the previous report for the species (Löve and Kapoor, 1967, Taxon 16: 565).

THALICTRUM SPARSIFLORUM Turcz. ex Fisch. & Mey. (Fig. 8) $2n = 14$. COLO., Larimer Co., *Gardner 233* (RM). The only previous report for this species gives a chromosome number of $2n = 42$ (Kuhn, 1928, Jahrb. Wissensch. Bot. 68: 382[1]) and contrasts sharply with the diploid determination presented here.

REVIEWS

THE PLANTS OF SOUTHERN NEW JERSEY. Stone, Witmer. Quarterman Publications, Inc., 5 South Union Street, Lawrence, Mass. 01850. $25.00.

This is a reprint of Witmer Stone's publication of some 63 years ago. There is a new foreword by Elizabeth M. Woodford. This tome has 914 pages and is well bound (hardback).

It is always a surprise when a "Manual" or "Flora" is good reading but this one is! The chatty observations about many of the taxa are often delightful and betray the author's intense personal interest in his work. The price is a bit high for the average botanist but well worth it. The usual problems of a reprint involving updating taxonomic concepts and the incorporation of recent researches exist but do not seriously detract from its interest or usefulness.—*Chester M. Rowell, Jr., Angelo State University, San Angelo, Texas 76901*

THE EFFECTS OF ECOLOGICAL CHANGES ON BUCKEYE LAKE, OHIO WITH EMPHASIS ON LARGEMOUTH BASS AND AQUATIC VASCULAR PLANTS. John Bayless Judd and Stephen Taub. Biological Notes No. 6, Ohio Biological Survey, Ohio State University, Columbus, Ohio 43210. 1973. $1.50 paperback.

Biological Notes of the Ohio Biological Survey are published at irregular intervals and include such works as *Lichens of Ohio* by Taylor (No. 3, 1967 and No. 4, 1968) and *The Vascular Flora of Glen Helen, Clifton Gorge,* and *John Bryan State Park* by Anliot (No. 5, 1973). The most current in this series deals with ecological changes in Buckeye Lake, Ohio. Buckeye Lake is a shallow, eutrophic lake with an area of approximately 1200 hectares. It was constructed in 1825 as part of the Ohio-Erie Canal and is thus a very old reservoir by today's standards.

This publication is divided into a discussion of historical changes, present and past plant associations, basic chemical limnology, and an extensive examination of past and present fish populations including growth studies and parasitology.

The botanist will find that the treatment of aquatic vascular plant ecology is particularly interesting. The authors found that species diversity has declined rapidly in the 20th century and important groups such as *Elodea* and *Utricularia* have been eliminated by various drainage and construction projects. They in turn state that the decline in productivity of the Largemouth Bass is directly correlated to increasing eutrophication and lack of plant cover.

Data presented concerning the physical limnology of Buckeye Lake was somewhat disappointing as relatively few sites were examined and parameters studied were limited. Judd and Taub believe that increasing turbidity

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has played a severe limiting factor to the growth and stability of both aquatic plants and fish populations. Also, general statements concerning fish parasites were based on too little data, but nevertheless, the fishery biologist, plant ecologist, and limnologist would find this work to be extremely valuable. The *Effects of Ecological Changes on Buckeye Lake* presents a written and photographic documentation of eutrophication over an extended period of time. This type of work is all too rare in today's literature.—*John O. Mecom, Biology Department, Southern Methodist University, Dallas, Texas, 75275.*

THE VASCULAR FLORA OF GLEN HELEN, CLIFTON GORGE, AND JOHN BRYAN STATE PARK by Sture F. Anliot. vii + 162 pp., 13 figs. Biological Notes No. 5, Ohio Biological Survey, Ohio State University, Columbus, Ohio 43210. 1973. $3.00 paperback.

This annotated checklist follows the format which has become more or less standard for this type of work. A brief summary of the geography and geology of the study area in north-central Greene County, Ohio, is followed by descriptions of the vegetational communities encountered there. Photographs of typical stands of these communities are included. The checklist reports 872 species, 25 varieties, and 13 forms, nearly half of which represent new reports for Greene County. Notations for each taxon in the checklist include common name, contemporary (only) synonyms, subjective estimate of abundance, habitat, growth form, flowering and fruiting period, and distribution within the state. Origins of naturalized and adventive taxa and separate indexes to scientific and common names are included.—*Jerry M. Flook, Herbarium, Southern Methodist University, Dallas, Texas 75275.*

Errata Graviora in SIDA 5(3)

p. 142, line 40. Insert:

1956x. *Prunus americana* var. *lanata* a synonym of *P. nigra*. Rhodora 58: 330-331.

1956y. *Vicia grandiflora* var. *kitaibeliana* in the Southeastern United States. Castanea 21: 151-152.

p. 142, line 41. 1956x should read 1956z.

p. 179, column 2, line 10. Should read *Vicia* 1948a, 1948c, 1956y.

JOHN F. COOKE, JR., 1927-1970[1]

John F. Cooke, Jr. was Assistant Professor of Botany at Southern University, Baton Rouge, Louisiana, when he died of an aortic aneurysm while driving his car in that city. Known as "Jack" to his many friends at The Ohio State University and Cornell University, where he did graduate work, his career as a university professor and professional botanist was short-lived.

Born 7 August 1927 in Woodbury, New Jersey, Jack attended Merion Grammar School in Merion, Pennsylvania, from 1933 to 1941, and Morse High School, Bath, Maine, from 1941 to 1945. Upon graduation from high school, Jack enlisted in the United States Navy, serving as a Reserve Seaman, 2nd Class. His tour of duty was for thirteen months, nine of which were aboard the U. S. S. DEVICE, a mine sweeper. Beginning in 1946, Jack enrolled as an undergraduate in the College of Arts and Sciences at Cornell University, Ithaca, New York, where he took various courses. Botany and Floriculture were his major interests, and he graduated in June 1950 with a B.A. in Botany.

For 2 years following graduation, Jack was employed by the W. Atlee Burpee Company of Philadelphia. During summers, he worked at their Fordhook Farms in Doylestown, Pennsylvania, doing planting, maintenance, flower trial rating, and pest control. In the winters he was in Philadelphia involved with seed ordering, the bulb department, and catalogue mailing; later he served in the purchasing department. From 1953 to 1956, he was employed as a garden superintendent by the Board of Education of Cleveland, Ohio. While there he also was assistant supervisor of greenhouses for West Technical High School during 1953-1954. Horticulture as a science and as a practical phase of business was taught as a part of the science curriculum. Jack directed three to eight individuals. Later, 1954-1956, he became assistant to the instructor in charge of the school landscaping program. He became involved in the fall landscaping and spring planting program of the Cleveland Public Schools. In addition, he taught general gardening to adult night-school classes. From 1956 to 1960 employment was with S. C. Johnson, Inc., Cleveland, Ohio, S. S. Pennock, Co. (wholesale florists), Philadelphia, and with J. A. Pullen Greenhouses, Houma, Louisiana. In the last company he was a partner.

Jack returned to Cornell University in 1960 and enrolled in the Graduate School for study in the Department of Floriculture and Ornamental Horticulture. He held a graduate assistantship in floriculture where he was teaching assistant for the course in Taxonomy of Cultivated Plants. He demonstrated great ability in handling and instructing students, displaying strong initiative in presenting the subject matter. In the latter part of his term at Cornell University, Jack was given full charge of instructing in the lab-

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[1] Contribution from the Department of Botany (Paper No. 835) and the Herbarium, The Ohio State University.

SIDA 5(4): 297—300. 1974.

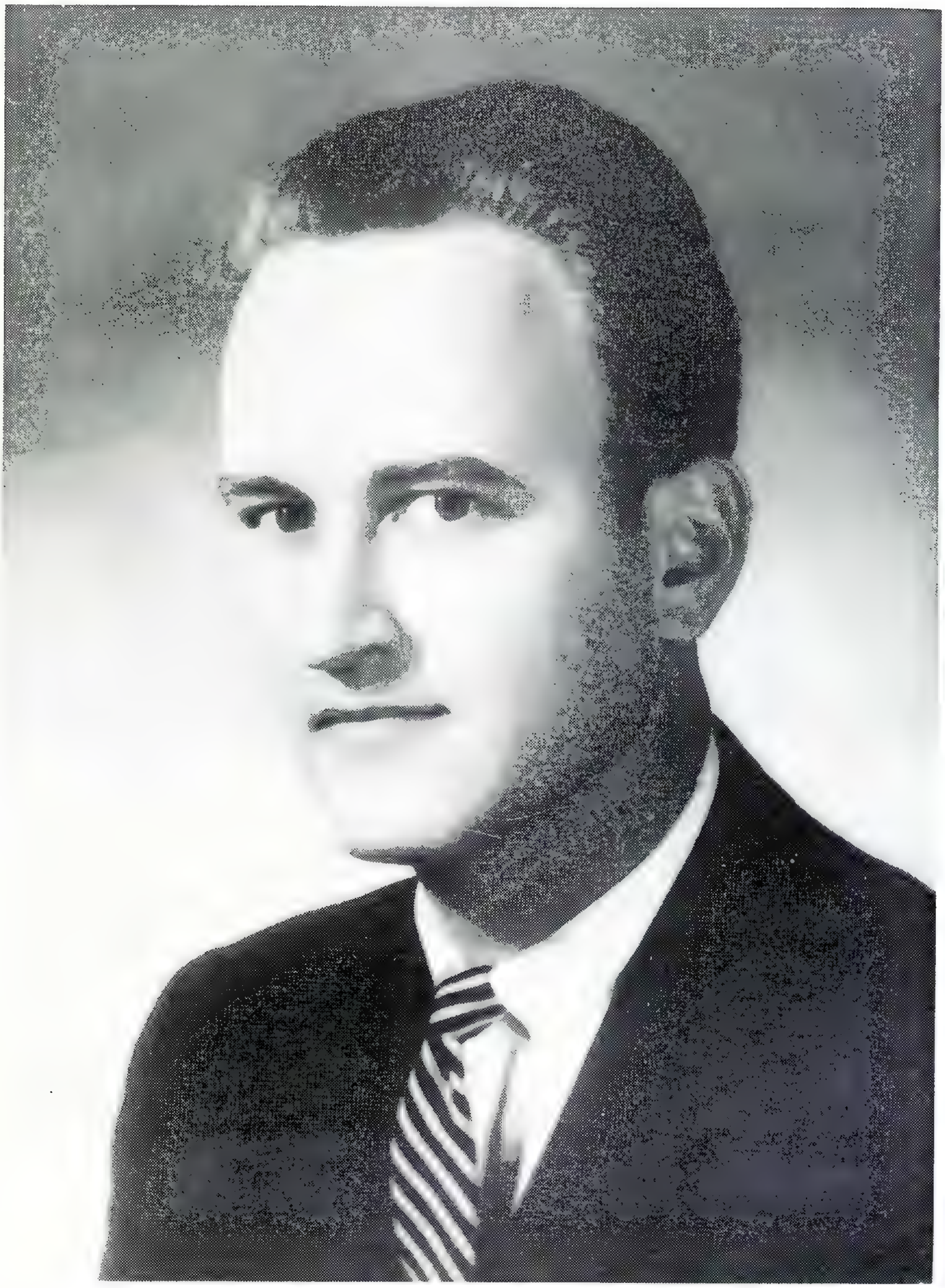
oratory, of collecting plant materials used in classes and of maintaining the teaching herbarium. His research involved the cytology of and hybridization within and between *Achimenes* and *Smithiantha*. He produced the first tetraploid hybrid, × *Eucodonopsis*, between these two genera, which was entered into trade with the cultivar name, 'Diamond Lil.' His M. S. Thesis, entitled, *Interspecific hybridization in the genus Achimenes P. Br.* (183 pp. + v, and several plates, diagrams, and tables), was completed under the direction of Professor Robert E. Lee. The M. S. degree was awarded in January 1963.

Jack enrolled for graduate work in the Department of Botany and Plant Pathology at The Ohio State University in January 1963. He studied in the area of experimental plant taxonomy with emphasis on cytotaxonomy and cytogenetics under the guidance of Professors T. Richard Fisher and Elton F. Paddock. He assisted and taught in the General Botany and Local Flora courses, and assisted in Plant Genetics, Basic Concepts in Botany, and Taxonomy of Vascular Plants. His background in horticulture and floriculture made him one of the most diverse students in the taxonomy program during the time Dr. Fisher was directing it. Jack frequently drew upon his knowledge of horticultural plants for examples in his teaching. The Ph. D. degree was awarded in the summer of 1968, with the completion of his dissertation, *The chromatography and cytology of some cultivated taxa of the genus Hosta Tratt.* (97 pp.), completed under the direction of Professor Fisher.

Jack was elected to two honor societies, Pi Alpha Xi (Floriculture Honorary Fraternity) and Sigma Xi, and was a member of several societies, the American Gloxinia and Gesneriad Society, American Society for Horticultural Science, American Society of Plant Taxonomists, Botanical Society of America, International Association for Plant Taxonomy, and the Ohio Academy of Science. College teaching as a career began in the fall of 1968, when Jack became Assistant Professor of Botany at Southern University, Baton Rouge, Louisiana, where he taught courses in general botany and plant taxonomy. His new career, just beginning, was short-lived. He died at the age of 42 on 12 January 1970.

Jack never married. He is survived by his parents and one sister. Interment was in Oak Grove Cemetery, Bath, Maine. At Morse High School in Bath, Jack's parents established in his memory The Dr. John F. Cooke, Jr. scholarship to be presented annually to a graduating student planning to major in one or more of the life sciences, with a preference for botany.

Jack had many interests other than those connected with plant science. He enjoyed the study of language, especially the derivation, history, and precise use of words. He was fun-loving; he enjoyed pleasant little jokes—those played on him as well as those he played on others. Jack could tell a good story, and he laughed easily. He liked cooking and was always on the lookout for new and exotic foods. The guests he entertained in his home were sure to enjoy the atmosphere of warm genial hospitality, the good food (prepared by Jack himself), and the sparkling conversation. All in all, he was a thoroughly delightful person, a highly respected colleague, and a



Dr. John F. Cooke, Jr. (photograph taken in the fall of 1964)

staunch friend. His passing has left an abysmal void in the hearts of all of us who were privileged to be his associates.

Publications:

1955

Gardening in the Cleveland Public Schools. Plant Life 11: 30-31.

1962

The chromosome number of *Achimenes woodii* Morton. Baileya 10: 53.

1963

The stigma of *Achimenes glabrata*. Baileya 11: 47.

1965

Plantain lilies bloom in shady areas. The Cleveland Plain Dealer Garden Planning Guide. 23 April. p. 11.

1966

Trumpet best known of four types of lilies. The Cleveland Plain Dealer Garden Planning Guide. 15 April. p. 14.

Hybridization within and between *Achimenes* P. Br. and *Smithiantha* Kuntze (Gesneriaceae). Baileya 14: 92-101. (with Robert E. Lee).

A new tetraploid × *Eucodonopsis*. African Violet Magazine 20 (2): 45-56.

1967

× *Eucodonopsis* 'Diamond Lil.' The Gloxinian 17 (3): 25-26.

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SIDA CONTRIBUTIONS TO BOTANY

VOLUME 5 NUMBER 5 DECEMBER 1974

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SIDA, founded by Lloyd H. Shinners, is privately published and edited by Wm. F. Mahler, SMU Herbarium, Dallas, Texas, 75275, U.S.A. Subscriptions: Libraries—$6.00 (U.S.) per year; individuals—$8.00 (U.S.) per volume; numbers issued twice a year.

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SIDA Contributions to Botany
Volume 5 Number 5, pages 301-361
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A TAXONOMIC RE-EVALUATION OF THE GENERA AMPHIACHYRIS, AMPHIPAPPUS, GREENELLA, GUTIERREZIA, GYMNOSPERMA, THUROVIA, AND XANTHOCEPHALUM (COMPOSITAE)

JOHN RUFFIN

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The Compositae, one of the largest families of vascular plants, are one in which evolutionary modifications are complex and poorly understood. Generic boundaries within many of the groups are obscure and, therefore, controversial. Generic delimitation of *Xanthocephalum*, *Gymnosperma*, *Gutierrezia*, *Amphiachyris*, *Amphipappus*, and *Greenella* (Astereae, subtribe Solidagineae) is confused. As a consequence, I undertook the present investigation, which has three objectives: (a) to reevaluate the taxonomic position of the genera by attempting to quantify and assess the gross morphological variation among the various groups, (b) to conduct a comparative anatomical study to determine whether endomorphic characters support the relationships suggested by gross morphology and cytology, and (c) to determine phylogenetic or evolutionary relationships from anatomical data.

A somewhat detailed historical account of most of these genera is given by Solbrig (1960). The present account adds some additional data.

Xanthocephalum was the first genus of this group to be described—in 1807 by Willdenow, based on material collected and described by Humboldt (Solbrig, 1961).

Gray (1873), recognizing the close similarities between *Xanthocephalum* and *Gutierrezia*, placed both X. *gymnospermoides* and X. *wrightii* in *Gutierrezia*, emphasizing that the line separating the genera was not perfectly clear. Gray also held *Gutierrezia* to comprise *Amphipappus* as well as *Amphiachyris* but later (Gray, 1884) felt that *Amphipappus* should be merged with *Amphiachyris* and kept separate from *Gutierrezia*. This transfer was justified because of the sterile disk florets and the quite setose pappus of both *Amphipappus* and *Amphiachyris*.

Bentham and Hooker (1873) adopted Gray's original treatment for the group. They merged *Amphiachyris* as well as *Amphipappus* with *Gutierrezia* and placed this group near *Gymnosperma* and *Xanthocephalum*.

According to Nelson (1934), *Amphipappus* and *Amphiachyris* should remain distinct genera, since *Amphiachyris* was based upon an annual herb, *A. dracunculoides*, "differing in many respects from *Amphipappus*." Porter (1943), agreeing with Nelson's line of reasoning, considered *Amphipappus* distinct.

SIDA 5(5): 301—333. 1974.

The morphological similarity of *Greenella* Gray to *Gutierrezia* and *Xanthocephalum* is unquestionable, and both Gray (1884) and Shinners (1950) doubted the distinctness of that genus. According to Gray (1884), in the original description of the genus, "if the ray-flowers of this plant were yellow instead of white, it would be referred to the genus *Xanthocephalum*, and the habit is nearly that of *X. linearifolium* and *X. sericocarpum*."

More recently, further opposing views as to the taxonomic status of these genera have been recorded. According to Shinners (1950), the quite variable features of pappus, size of heads, and number of rays did not constitute differences sufficient to justify maintaining separate genera. To Shinners the fact that they were of one phylogenetic stock was unquestionable, and in view of the slight differences among them, Shinners felt they represented a single genus. Solbrig (1960) conducted a cytological and morphological study and concluded that certain morphological features in combination could be used to delimit the genera but that they often were insufficient when used alone. Chromosome number, however, proved to be a distinguishing character. This criterion, in Solbrig's opinion, was sufficient to delimit the genera satisfactorily.

Howe (1970) reported on megagametogenesis for *Gutierrezia microcephala* and *G. texana* and compared it with that of *Amphiachyris dracunculoides*. According to Howe, the differences in the female gametophytes supported the retention of *Amphiachyris* as a genus distinct from *Gutierrezia*, thus agreeing in part with Solbrig.

While Solbrig's cytological conclusion seems tenable, recent inconsistencies in chromosome numbers in the various genera, not reported in Solbrig's work, raise questions as to the placement of the groups and warrant reassessment of their status.

Shinners (personal communication), Spencer Tomb (personal communication), and Correll and Johnston (1970) suggested that the monotypic genus *Thurovia* Rose is also closely related to the *Xanthocephalum* complex. Rose (1895), in the original description, noted that, from the head structure and the general habit, *Thurovia* apparently belonged to the tribe Astereae and that the habit of *Thurovia* was like that of *Gutierrezia* or *Greenella*. Thus, my investigation also includes a study of *Thurovia*.

MATERIALS AND METHODS

Fresh plant material for anatomical studies was killed and fixed in either chromic-acetic-formalin or formalin-propionic-alcohol (CRAF and FPA, respectively; Sass, 1958), dehydrated through a graded tertiary butyl-alcohol series, infiltrated, embedded, and sectioned in paraffin. Dried material judiciously taken from herbarium sheets was restored by immersion in 3% aqueous sodium hydroxide and then was dehydrated and processed as described above.

Many of the data on gross morphology were obtained by measuring 15 characters on each of 10 plants per collection. To reduce error variation,

only plants in anthesis (showing pollen shedding) were chosen for measurements.

To standardize leaf measurements, the maximum length of the current year's growth was first measured from the base of the year's growth (or base of the plant, for annuals) to the tip of the longest branch. Measurements were made on the leaf nearest the midpoint of the current year's growth. For involucral and floral characters one flower head was chosen from each plant, placed in 50% ethyl alcohol, and measured later. To standardize this procedure and choose heads of the same relative maturity, the flower head nearest the terminal head on the branchlet nearest the midpoint of the current year's growth was chosen.

Whole leaves and flowers for venation studies were cleared and stained as described by Fuchs (1963).

Table 1 shows the sources of the materials used in my morphological studies.

OBSERVATIONS

Involucre and receptacle. Comparative morphological and histological studies of the involucre and phyllaries (involucral bracts) show few major differences and are not useful in delimiting the genera.

Greenella, *Gutierrezia*, and *Xanthocephalum* possess an involucre varying from narrowly turbinate to broadly campanulate. *Amphiachyris* has a somewhat broadly campanulate involucre, and *Gymnosperma*, *Amphipappus*, and *Thurovia* possess elongate-turbinate involucres.

Involucral bracts of the genera are glutinous, in two to many rows, imbricated, and dark green at the tips. In all the groups the number of bracts appears to correlate well with the size of the involucre (Table 2).

Histologically, in all species studied the outer phyllaries are four to seven cells thick. In *Greenella, Gutierrezia, Gymnosperma,* and *Xanthocephalum* (except *X. wrightii* and *X. linearifolium)* only one vascular trace enters each bract. Heads of *X. wrightii* have three traces in the outer bracts and one trace in each innermost bract. *Xanthocephalum linearifolium* shows three to five bundles in the outer bracts. In comparison, *Amphipappus* commonly shows three bundles in its bracts, and *Amphiachyris* has as many as five traces in the outer bracts. Heads of *Thurovia*, like *X. linearifolium*, have three to five bundles in the outer bracts.

One to five secretory canals occur in the outer bracts in all species studied. These canals are, for the most part, conspicuous on the adaxial side of the vascular bundles.

All of the species in each genus possess sclerenchyma in the outer bracts. The degree of sclerification is so pronounced that in most species the vascular bundles are usually enveloped in sclerenchyma, which is more abundant near the base of the bracts. Many inner bracts appear to be entirely sclerified except in the epidermal layers. In *Amphipappus* the central area of the larger bracts, six to seven cells thick, consists of a layer of spongy

TABLE 1. Sources of material used in morphological studies of *Amphiachyris*, *Amphipappus*, *Greenella*, *Gutierrezia*, *Gymnosperma*, *Thurovia*, and *Xanthocephalum*

(Voucher specimens are in KSC unless otherwise indicated)

Species	Collection	Location
Amphiachyris amoenum var. *amoenum* (Shinners) Solbrig	*Ruffin 7033*	Texas: Montague Co., 7 mi NE of Montague.
	Ruffin 7034	Texas: Johnson Co., 13.7 mi SW of Cleburne.
	Ruffin 7035	Texas: Lampasas Co., 3.4 mi NW of Lampasas.
A. amoenum var. *intermedium* (Shinners) Solbrig	*Ruffin 7030*	Texas: Milan Co., N side of Ben Arnold between hwy and railroad.
	Ruffin 7031	Texas: Washington Co., 2½ mi NE of Burton at jct of hwys 390 and 1948.
	Ruffin 7032	Texas: Montague Co., 7 mi NE of Montague.
A. dracunculoides (DC.) Nutt.	*Ruffin 7036*	Kansas: Geary Co., 9 mi W of Junction City along hwy 77.
	Ruffin 7037	Kansas: Riley Co., 13½ mi S of Manhattan along hwy 177.
	Ruffin 7038	Kansas: Chase Co., 25 mi NE of El Dorado.
	Ruffin 7039	Texas: Brewster Co., along hwy 118 S of Alpine.
	Anderson 3005	New Mexico: Chaves Co., 5 mi N of Roswell.
Amphipappus fremontii Torr. & Gray	*Clokey 5962*	Nevada: Clark Co., Glendale Junction, Rocky Hills, Larrea Belt.
Greenella arizonica Gray	*Peebles et al. 3842* (US)	Arizona: Pima Co., Papago Reservation.
G. ramulosa Greene	*Anthony 321* (MO)	Lower California: San Bartolome Bay area.
Gutierrezia californica DC.	*Krikorian s.n.**	California: Fresno Co., Parkfield Grade, NW of Coalinga.
G. mandonii ssp. *mando-*	*Venturi 8156* (US)	Argentina: Prov. Jujuy;

nii (Sch. Bip.) Solbrig		Dept. Rosario de Lerma.
G. microcephala DC.	*Ruffin 7005, 7006*	New Mexico: Grant Co., 15 mi N of Silver City off hwy 25, 6600 ft. (*7005*); 8800 ft. (*7006*).
G. sarothrae Pursh	*Ruffin 7001*	New Mexico: Grant Co., 6 mi N of Silver City along Signal Peak Road.
	Ruffin 7002	Kansas: Logan Co., 20 mi SW of Oakley along hwy 83.
	Ruffin 7003	Kansas: Scott Co., 10 mi E of Scott City.
	Ruffin 7004	Kansas: Ness Co., 13 mi NE of Ness City along hwy 283.
G. texana DC.	*Ruffin 7007* *Anderson 3028*	Texas: Brewster Co., along hwy 118 S of Alpine.
	Ruffin 7008	Texas: Burleson Co., along hwy 290; S of Giddings.
	Ruffin 7009	Texas: Washington Co., 1 mi NE of Burton along hwy 390.
Gymnosperma glutinosum (Spreng.) Less.	*Ruffin 7010*	New Mexico: Grant Co., 5 mi N of Silver City on Cottage Sand Road.
	Ruffin 7011	New Mexico: Hidalgo Co., 1 mi W of Cloverdale on hwy 77.
	Ruffin 7012	Texas: Brewster Co., 21 mi S of Marathon on road to Big Bend National Park.
	Ruffin 7013	Texas: Brewster Co., along hwy 118 S of Alpine.
Thurovia triflora Rose	*Tharp 280* (TEX)	Texas: Jackson Co., Coastal flat near mouth of Lavaca River.
Xanthocephalum centauroides Willd.	*Palmer 501* (MO)	Mexico: City of Durango and vicinity.
X. gymnospermoides (Gray) Benth. & Hook.	*Ruffin 7024, 7025, 7026*	Arizona: Cochise Co., Garden Canyon, Huachuca Mts., 6000 ft (*7024*); 5500 ft (*7025*); 6200 ft (*7026*).
X. humile (HBK.) Sch. Bip.	*Pringle 7422* (US)	Mexico: Distrito Federal; northern puebla.
X. linearifolium (DC.)	*Leavenworth 950*	Mexico: Serrania de Ajusco

Greenm.		near Cima Station.
X. sericocarpum Gray	*Palmer 143* (US)	Mexico: city of Durango and vicinity.
X. wrightii (Gray) Gray	*Ruffin 7020*	New Mexico: Catron Co., 18 mi NE of Mogollon on hwy 78.
	Ruffin 7021	New Mexico: Grant Co., 11 mi NE of Silver City at bottom of Cherry Creek Canyon.
	Ruffin 7022, 7023	Arizona: Cochise Co., Garden Canyon, Hauchuca Mts., 6000 ft (*7022*); 5500 ft (*7023*).

**Gutierrezia californica* has been described as being restricted to the area of San Francisco Bay, California (Solbrig, 1960). Material collected by Krikorian places this species about 80 mi S of its previously-known range.

TABLE 2. Averages (in mm) for floral features of *Amphiachyris*, *Amphipappus*, *Greenella*, *Gutierrezia*, *Gymnosperma*, *Thurovia*, and *Xanthocephalum*

		involucre			flowers					
Species	Voucher	length	width	bract number	ray number	disc number	achene length (disc)	achene length (ray)	length of corolla (disc)	width of corolla (disc)
Amphiachyris amoenum var. *amoenum*	*Ruffin 7033*	3.8	3.4	16.2	8.0	26.9	—	1.0	2.4	0.6
	Ruffin 7034	4.0	3.6	16.3	7.9	26.6	—	0.9	2.6	0.6
	Ruffin 7035	3.6	3.3	15.5	8.0	24.2	—	0.9	2.4	0.6
A. amoenum var. *intermedium*	*Ruffin 7030*	3.6	3.3	14.2	8.0	19.4	—	1.0	2.5	0.7
	Ruffin 7031	3.8	3.3	14.7	8.0	20.6	—	0.9	2.6	0.7
	Ruffin 7032	3.7	3.5	15.0	8.0	20.3	—	0.9	2.6	0.7
A. dracunculoides	*Ruffin 7036*	2.7	2.3	14.7	8.0	28.5	—	1.0	2.4	0.5
	Ruffin 7037	2.8	2.5	15.0	8.0	28.1	—	1.0	2.5	0.6
	Ruffin 7038	2.6	2.2	15.4	7.9	25.3	—	1.0	2.4	0.6
	Ruffin 7039	2.9	2.5	14.3	8.0	26.2	—	1.0	2.4	0.6
Amphipappus fremontii	*Clokey 5962*	4.4	2.0	8.0	1.6	4.2	1.0	2.6	3.6	0.7
Greenella arizonica	*Peebles et al. 3842*	3.6	3.4	16.9	13.0	30.4	1.0	1.0	2.9	0.6

Gutierrezia californica	*Krikorian s.n.*	6.1	2.5	19.4	8.8	10.6	1.2	1.0	3.2	0.9
G. microcephala	*Ruffin 7005*	3.1	1.0	4.5	1.2	1.3	—	1.0	2.3	0.5
	Ruffin 7006	3.2	1.0	4.4	1.1	1.5	—	1.0	2.4	0.5
G. sarothrae	*Ruffin 7001*	3.4	1.5	11.6	5.0	3.6	1.0	1.1	2.7	0.6
	Ruffin 7002	3.2	1.5	12.1	5.0	3.4	1.0	1.1	2.6	0.6
	Ruffin 7003	3.3	1.4	11.2	4.9	3.2	1.0	1.1	2.6	0.7
	Ruffin 7004	3.2	1.5	11.8	5.0	3.4	1.0	1.0	2.6	0.7
G. texana	*Ruffin 7007*	3.1	3.3	17.2	10.4	17.2	1.0	0.8	1.9	0.8
	Ruffin 7008	3.1	3.5	16.6	10.3	17.4	1.0	0.9	1.7	0.8
	Ruffin 7009	3.3	3.2	17.9	11.8	17.9	1.0	0.9	1.8	0.8
Gymnosperma glutinosum	*Ruffin 7010*	3.8	1.6	10.1	7.1	4.4	1.0	1.3	3.3	0.8
	Ruffin 7011	3.6	1.6	11.0	7.3	4.8	1.0	1.3	3.3	0.8
	Ruffin 7012	3.9	1.7	10.6	7.4	4.9	1.0	1.2	3.2	0.3
	Ruffin 7013	4.0	1.7	10.4	7.1	4.6	1.0	1.3	3.1	0.3
Thurovia triflora	*Tharp 280*	3.5	2.1	7.2	0.0	3.0	1.0	0.0	2.4	0.8
Xanthocephalum centauroides	*Palmer 501*	4.7	5.7	43.2	32.6	49.4	1.0	1.0	4.0	0.7
X. gymnospermoides	*Ruffin 7024*	5.0	5.9	42.9	37.6	160.0	1.0	1.0	4.2	0.6
	Ruffin 7025	4.9	5.5	41.8	34.3	157.8	0.9	1.0	4.1	0.6
	Ruffin 7026	5.2	6.3	43.7	41.5	162.7	1.0	1.1	4.4	0.5
X. linearifolium	*Leavenworth 950*	5.6	6.9	24.6	13.2	67.8	1.0	1.0	3.2	0.6
X. sericocarpum	*Palmer 143*	5.7	6.7	33.2	32.4	120.6	1.0	0.9	3.5	0.3
X. wrightii	*Ruffin 7020*	5.3	5.9	22.2	12.7	47.1	1.0	1.0	3.7	0.8
	Ruffin 7021	4.7	5.6	24.4	12.4	45.6	1.0	1.0	2.9	0.8
	Ruffin 7022	5.3	5.9	20.3	12.0	46.3	1.0	1.0	3.6	0.7
	Ruffin 7023	5.4	6.0	23.4	11.9	47.4	1.0	1.1	3.7	0.6

mesopyhll, three to four rows of sclerenchyma adjacent to the abaxial epidermis, and two to three rows of parenchyma between the sclerenchyma and the adaxial epidermis.

In all species studied, the inner bracts, in contrast to the outer, are relatively longer and narrower. Particularly noteworthy is the strong alignment of bracts in *Greenella ramulosa* (Fig. 15d), a condition not encountered in any other species.

Uniseriate as well as multiseriate glandular trichomes may occur along the outer as well as the inner epidermis of most species of *Gutierrezia*, *Greenella*, *Xanthocephalum*, *Thurovia*, and *Amphipappus*. However, in *G. texana*, *G. sarothrae*, *X. gymnospermoides*, and *Amphipappus*, trichomes about two to three cells high are especially abundant along both surfaces. In *Gymnosperma* and *Amphiachyris*, glandular trichomes occur almost ex-

clusively along the adaxial epidermis.

The receptacles of most species studied appears flat or somewhat convex. However, in *X. sericocarpum*, the receptacle is more conical in form.

Occurring on the receptacle of all species of *Gutierrezia*, *Greenella*, and *Thurovia* and of most species of *Xanthocephalum* are characteristic hook-like glandular trichomes (Fig. 14b-d); these are lacking only in *X. gymnospermoides*, *X. humile*, and *X. centauroides*. They usually are four to eight cells long. The presence of these glands in the above genera appears to be a unifying feature; they are absent in *Amphiachyris*, *Amphipappus*, and *Gymnosperma*.

Achene. In all of the genera both disc and ray achenes show little morphological variation, appearing turbinate and slightly flattened.

A single vascular bundle from the receptacle extends into the base of the disc achene. According to Carlquist (1961), this condition is common in most Compositae. Bundle number in the groups is two to 10 in the ovary. *Gutierrezia taltalensis*, *Greenella ramulosa*, and *Gymnosperma glutinosum*, with ten outer vascular bundles in the achene wall, are regarded as representing a more primitive condition. *Xanthocephalum gymnospermoides*, with two to three achene bundles, represents the advanced condition. *Greenella arizonica* is particularly interesting in terms of the secretory canal distribution on the wall of the achene. There are five bundles but 10 secretory canals. A secretory canal is adaxial to each bundle and one is between each two bundles. *Amphipappus* exhibits five to seven achene bundles with no secretory canals on the achene wall. In the other species the number of secretory canals correlates well with the number of bundles in the achene wall. In *Gutierrezia microcephala* (Fig. 6) and all species of *Amphiachyris* (Figs. 9, 10, 11) the disc florets are aborted, but five bundles are present in the outer wall of the ray achene. *Thurovia triflora* shows about the same degree of specialization as the majority of *Gutierrezia* and *Xanthocephalum* species although commonly nine bundles were seen in the achene wall with a secretory canal adaxial to each bundle.

Trichomes in all of the genera, when present on disc or ray achenes, are of the "Zwillingshaar" type, a biseriate non-glandular trichome. In all species studied the tips of the two apical cells usually do not terminate at the same point. The length of these trichomes is generally 70–550 μm. The shortest of these occur in *Gymnosperma*, and the longest, in *Thurovia*. The only other variation noted was the papillate hairs of *Thurovia* and *X. gymnospermoides*; the trichomes appear to arise from little mounds on the achene wall (Fig. 14a).

Disc and ray corollas. The ray corollas show significant differences in average number, width, and length among genera as well as within a single genus. The five-lobed disc corollas show minor differences in length and width but vary tremendously in terms of number per head.

In all of the species studied the tendency is toward more disc florets than ray florets. Tables 2 and 3 show the counts and measurements of these.

TABLE 3. Averages (in mm) for floral features and leaves of *Amphiachyris*, *Amphipappus*, *Greenella*, *Gutierrezia*, *Gymnosperma*, *Thurovia*, and *Xanthocephalum*

Species	Voucher	length of ray	width of ray	length of style appendage (disc)	length of style branch (disc)	length of style branch (ray)	length of pappus (disc)	length of pappus (ray)	leaf width	leaf length
Amphiachyris amoenum var. *amoenum*	*Ruffin 7033*	6.5	1.9	—	0.7	0.9	2.3	0.1*	1.7	22
	Ruffin 7034	6.9	1.9	—	0.7	0.9	2.5	0.1*	1.6	29
	Ruffin 7035	6.6	1.8	—	0.6	0.9	2.2	0.1*	1.8	26
A. amoenum var. *intermedium*	*Ruffin 7030*	4.2	1.7	—	0.6	1.0	2.4	0.1*	1.8	22
	Ruffin 7031	4.3	1.8	—	0.6	1.0	2.5	0.1*	1.8	22
	Ruffin 7032	4.2	1.9	—	0.7	1.0	2.4	0.1*	1.5	14
A. dracunculoides	*Ruffin 7036*	3.2	1.9	—	0.8	0.8	2.3	0.1*	2.0	20
	Ruffin 7037	3.3	1.8	—	0.8	0.9	2.4	0.1*	1.7	20
	Ruffin 7038	3.0	1.9	—	0.7	0.9	2.3	0.1*	1.9	27
	Ruffin 7039	3.7	1.9	—	0.7	0.9	2.3	0.1*	1.7	22
Amphipappus fremontii	*Clokey 5962*	2.5	1.4	0.3	0.5	1.2	3.7	2.9	6	11
Greenella arizonica	*Peebles et al. 3842*	10.3	1.7	1.0	1.9	0.9	0.3	0.1*	0.9	12
Gutierrezia californica	*Krikorian s.n.*	3.5	0.9	1.4	1.5	1.0	1.4	0.6	1.5	21
G. microcephala	*Ruffin 7005*	3.2	0.6	—	1.5	1.0	0.8	0.5	1.9	2.4
	Ruffin 7006	3.4	0.6	—	1.6	1.0	0.7	0.5	2.1	25
G. sarothrae	*Ruffin 7001*	4.2	1.0	1.4	1.6	0.6	1.0	0.3	1.2	17
	Ruffin 7002	4.1	1.1	1.5	1.6	0.6	1.0	0.2	1.4	19
	Ruffin 7003	4.1	1.0	1.5	1.7	0.6	0.9	0.3	1.5	19
	Ruffin 7004	4.0	1.0	1.4	1.6	0.6	1.0	0.3	1.4	18
G. texana	*Ruffin 7007*	3.3	1.3	0.2	1.0	0.5	0.7	0.1*	2.4	25
	Ruffin 7008	3.3	1.6	0.3	1.0	0.5	0.8	0.1*	2.2	24
	Ruffin 7009	3.6	1.3	0.2	0.9	0.7	0.8	0.1*	2	22
Gymnosperma glutinosum	*Ruffin 7010*	2.3	0.3	0.6	1.0	0.7	0.1*	0.1*	5.7	60
	Ruffin 7011	2.2	0.2	0.6	1.0	0.6	0.1*	0.1*	5.1	59
	Ruffin 7012	2.5	0.3	0.6	1.0	0.8	0.1*	0.1*	5.3	58
	Ruffin 7013	2.5	0.3	0.6	1.0	0.7	0.1*	0.1*	7	63

Thurovia triflora	*Tharp 280*	0.0	0.0	0.8	1.4	0.0	1.6	0.0	1.0	2.5
Xanthocephalum centauroides	*Palmer 501*	6.2	1.9	0.3	1.0	0.9	0.1	0.1	2.4	46
X. gymnospermoides	*Ruffin 7024*	7.4	1.5	0.2	1.0	0.9	0.5	0.1*	19.3	82
	Ruffin 7025	7.5	1.4	0.3	1.0	0.9	0.4	0.1*	14.7	72
	Ruffin 7026	7.4	1.7	0.2	1.0	0.9	0.5	0.1*	17.8	80
X. linearifolium	*Leavenworth 950*	7.9	2.1	1.3	1.5	0.7	0.4	0.1*	3.1	44
X. sericocarpum	*Palmer 143*	7.4	1.4	0.6	1.0	0.8	1.2	0.1*	2.1	34
X. wrightii	*Ruffin 7020*	7.8	2.8	1.2	1.5	0.7	0.1*	0.1*	3.1	42
	Ruffin 7021	7.9	2.8	1.2	1.5	0.7	0.1*	0.1*	2.4	30
	Ruffin 7022	8.1	3.1	1.2	1.5	0.7	0.1*	0.1*	2.2	36
	Ruffin 7023	8.0	3.0	1.2	1.5	0.6	0.1*	0.1*	2.1	29

* slightly less than 0.1.

Xanthocephalum shows the greatest degree of variation. In terms of number of ray florets present, it ranges from nine to 13 in *X. wrightii* to as many as 45 in *X. gymnospermoides*. *Gutierrezia* ranges from one to two ray florets in *G. microcephala* to as many as 14 in *G. texana*. *Greenella* commonly shows 13 ray florets, thus corresponding to the Fibonacci sequence.

The number of ray florets in *Gymnosperma glutinosum* ranges from six to eight. The length and width of the ray corolla exceeds that of the disc corolla in all of the species studied except in *Gymnosperma*, where the average length of the ray corollas is shorter than that of the disc corolla. *Gymnosperma* also shows a reduction in the number of teeth on the corolla tip. Most of the species commonly show three lobes at the apex of the ray corolla; *Gymnosperma*, commonly two lobes.

Amphipappus also shows a reduction in number of ray florets. Commonly one or two are present. The number of ray florets in *Amphiachyris* also corresponds to a Fibonacci sequence. All species of *Amphiachyris* studied had eight fertile ray florets. Ray florets are absent in *Thurovia*.

Histologically, the ray corolla of most species varies little. The tissues are composed mostly of parenchyma. At their broadest point the rays are five to eight cells thick in transection. The cells of the lower epidermis in all species are papillate (Fig. 15c), some more pronouncedly so than others. Secretory canals in the ray florets are found only in *X. wrightii*, where they appear adaxial (Fig. 15c) to each vascular bundle.

Uniseriate trichomes, usually of one to three cells, occur on the outer surface of the lobes of the ray and disc corollas. These trichomes are very infrequent but usually more abundant on the lobes of the disc corolla. *Xanthocephalum gymnospermoides* has both uniseriate and biseriate trichomes present on the lobes of its disc and ray corollas.

As in the ray florets, the inner surface of the lobes of the disc corolla is characterized by an abundance of papillate cells. The outer epidermal cells

of the disc floret in all species are highly cutinized. The disc lobes are from two to four cells thick. In each of the five lobes of the disc corolla in all the genera are two lateral vascular bundles. Very large secretory canals are associated laterally with each bundle. However they are less frequent and less conspicuous in the disc corollas of *X. wrightii* and *X. sericocarpum* and are absent in *Amphipappus*.

The vascular anatomy of the disc floret in all the genera appears to be fairly advanced. Carlquist (1961) has given a summation of vascular evolution in Compositae. Generally five vascular bundles occur in the base of the disc corolla. These bundles usually extend to the base of each lobe where the individual bundles fork, with a vein entering each adjacent lobe along the margin. The two veins in each of the lobes then meet and fuse at the very top of the lobe.

In all species studied, the tube of the disc corolla is five to eight cells thick just above the nectaries, and no secretory canals are present. Occasional biseriate and/or uniseriate glandular trichomes may be present on the corolla tube. However, in *X. gymnospermoides*, *X. humile*, and *X. centauroides*, the entire lower half of the corolla tube is covered with conspicuous glandular trichomes (Fig. 15a). This occurrence is of particular interest since these three species were the only members of the *Xanthocephalum* group studied that lacked the receptacular glands.

Pappus. Pappus development shows degrees of variation among as well as within genera and thus is a somewhat questionable taxonomic character as far as absolutely delimiting the groups. Generally speaking, all of the genera except *Amphiachyris* and *Amphipappus* can be characterized as having a scaly or reduced pappus in the disc as well as the ray florets. The reduced condition appears slightly more pronounced in *Gymnosperma* (Fig. 8a, b). The pappus of both ray and disc florets in *Amphipappus* is composed of long well-developed setae that are slightly shorter in the ray florets (Fig. 7a, b). The latter condition also characterizes the florets of *Amphiachyris*, except the pappus of the ray floret commonly possesses a low scaly crown (Figs. 9, 10, 11).

Anatomically the pappus of the various species shows very little cellular differentiation. In no instances were vascular traces seen in the pappus. The pappus in cross section appears variously shaped and is usually two to four cells thick at the widest.

Style. As described by Solbrig (1960), the styles of the ray florets are distinctly different from those of the disc ones in all of the species considered. These styles are characterized by two elongated branches with a border of papillae along both sides of the stigmatic branches. On the style branches of the disc florets the papillae are confined to the lower quarter on both sides or are absent, with collecting hairs covering the greater outside portion of the branches. Solbrig, in his assessment of this group, also pointed out that the style branches of the disc florets are shorter than those of the ray ones. However, actual measurements of the branches (Table 2) show

that the style branches are shorter in disc florets only in *Amphipappus* and *Amphiachyris* with the difference being slightly greater in *Amphipappus*.

Thurovia triflora shows the greatest degree of stylar variation (Fig. 12b). All the other taxa differ in minor respects. Style branches of *Thurovia* are characterized by short collecting hairs on the upper half of the branches. Just beneath the collecting hairs and some distance from the base of the branches are peculiar brush-like hairs. According to Rose (1895), this peculiarity led Hoffman in 1895 to conclude that perhaps *Thurovia* belonged with Heliantheae instead of Astereae.

In *Xanthocephalum*, *Gutierrezia*, and *Greenella* the styles of the disc florets possess triangular or elongate tips with collecting hairs occupying various degrees of the outer surface of the branches.

Node and leaf. Nodal anatomy proved to be a very conservative feature. In all species it is trilacunar with one trace per leaf gap (Fig. 15b).

Leaves of *Xanthocephalum* are alternate, linear-lanceolate to lanceolate, simple, and entire or shallowly toothed. Leaves of *X. gymnospermoides* and *X. centauroides* show the greatest amount of serration or toothing, but entire leaves may occur as well. *Xanthocephalum gymnospermoides* has the broadest leaves of all *Xanthocephalum* studied.

Leaves of *Gutierrezia*, *Greenella*, *Amphiachyris*, *Thurovia*, and *Gymnosperma* are also alternate and linear-lanceolate. Those of *Gymnosperma* are much longer than those of most species studied.

Leaves of *Amphipappus* are alternate, entire, and, in contrast to those of the other species, oval to elliptic or obovate. Table 3 gives averages for both length and width of leaves of certain species. Figure 13 shows some of the shape and venation patterns noted.

Leaf anatomy of the genera shows striking similarities. A pronounced cuticle covers the upper and lower leaf epidermis of all species studied. At regular intervals on both surfaces of the epidermis are narrow cavities. Within each of these cavities is one to two multiseriate glands (Fig. 16a, b). This condition was found in all the species except *Amphipappus*. Solbrig (1966) found this condition to be uniform in the South American *Gutierrezia*. In addition to the multiseriate glands within the cavities, *X. gymnospermoides*, *Gutierrezia texana*, *G. sarothrae*, *G. microcephala*, and *Thurovia* show infrequent uniseriate trichomes on the surface of the upper epidermis as well. In *Amphipappus*, uniseriate trichomes two to three cells high are frequent on the upper and lower surfaces.

In all species studied the mesophyll contains abundant chloroplasts throughout the tissue except for the parenchymatous sheath surrounding the collateral vascular bundles. The leaves have prominent secretory canals associated adaxially with the vascular bundles.

DISCUSSION AND CONCLUSIONS

Features of the pappus were used chiefly by earlier botanists in delimiting these genera with less emphasis being placed on other morphological fea-

tures. The character of the pappus, when coupled with features from other parts of the plant, is still a very important diagnostic feature. Solbrig (1960) points out that to use pappus characters successfully one must consider the pappus of both ray and disc florets. In addition one must comprehend the variation present in different species as well as the magnitude of variation within a given genus. *Gymnosperma* and *Greenella* are described by Solbrig (1960) as being similar in possessing, in both ray and disc florets, a reduced crown of minute scales instead of a well developed pappus. Yet in *Greenella ramulosa* both ray and disc florets have a well-developed pappus formed by lanceolate palae that resembles the characteristic pappus of *Gutierrezia*. The pappus of *Xanthocephalum* has been described as having only a low rim or crown in both ray and disc florets. Yet in *X. sericocarpum*, *X. linearifolium*, and *X. gymnospermoides* it is not uncommon to find well-developed pappi resembling to a great extent that in *Gutierrezia*. Certainly the nature of the pappus in *Amphiachyris* and *Amphipappus* is distinct enough to characterize these genera. Differences in structure and the fact that the ray floret in *Amphiachyris* does not show a well-developed pappus may serve as evidence for not including these two in the same genus.

The style of *Thurovia* definitely distinguishes it from the other genera. Even though these show some degree of coherence in style structure, it is worth noting that the style branch of the ray florets is longer than that of the disc florets in *Amphiachyris* and *Amphipappus* and no stigmatic papillae are present on the lower surface of the style branch. These characters can also be used to segregate the latter two genera from the others.

Amphipappus appears to demonstrate the greatest degree of differences in characters. In addition to those characters already mentioned, the structure of the leaves in *Amphipappus* is distinct from that of the other genera. In addition, secretory canals, except in the phyllaries, appear to be lacking. Sectioned leaves of all the other genera are almost indistinguishable, and secretory canals are frequent in various plant parts.

Certainly the occurrence of the hook-tipped receptacular glands in all species of *Gutierrezia* studied, in *Greenella*, and in *Xanthocephalum* adds unifying evidence to these previously distinct genera. In addition to the habit of *Thurovia* and other features already mentioned, the presence of these hook glands in *Thurovia* perhaps suggests the close relationship of *Thurovia* to the latter genera. A more thorough survey of the presence or absence of these glands in Astereae may prove valuable in determining the extent and usefulness of this character.

Because such few chromosome numbers were known in certain of the genera, a clear cytological concept of the groups was not perceived by Solbrig. At the time of Solbrig's study, the base chromosome number was considered to be four or a multiple of four in all *Gutierrezia* counted, five in *Amphiachyris*, seven in *Gymnosperma*, and nine in *Amphipappus*. Only one species of *Xanthocephalum* (*X. gymnospermoides*, $n=6$) and none of *Green-*

ella had been counted. In addition, Tomb (personal communication) has found $n=5$ for *Thurovia triflora*. Table 13 shows that counts now available for *Greenella arizonica* and for four more of the eight species of *Xanthocephalum* indicate a base of $n=4$. These findings certainly eliminate the generic differences suggested by Solbrig (1960) among *Xanthocephalum*, *Gutierrezia*, and *Greenella*.

TABLE 4. Previous meiotic chromosome counts in *Amphiachyris*, *Amphipappus*, *Greenella*, *Gutierrezia*, *Gymnosperma*, *Thurovia*, and *Xanthocephalum*

Species	Counts	Reference	Habit
Amphiachyris dracunculoides	$n=5$	Solbrig et al. (1964), Solbrig (1960).	annual
Amphipappus fremontii	$n=9$	Raven et al. (1960), Solbrig (1960).	perennial
Greenella arizonica	$n=4$	Solbrig et al. (1964).	annual
Gutierrezia californica	$n=8$, 12, 16 24	Rudenberg & Solbrig (1963).	perennial
G. mandonii ssp. *mandonii*	$n=12$	Solbrig (1966).	perennial
G. microcephala	$n=8$, 16	Solbrig (1960), Rudenberg & Solbrig (1963).	perennial
G. sarothrae	$n=4$, 8	Solbrig (1960), Rudenberg & Solbrig (1963).	perennial
	$n=8$	Solbrig et al. (1964), Solbrig (1965).	
G. texana	$n=4$	Solbrig (1960), Turner & Ellison (1960), Rudenberg & Solbrig (1963), Solbrig et al. 1964).	annual
Gymnosperma glutinosum	$n=7$, 8	Solbrig (1960), Solbrig et al. (1964), Solbrig et al. (1969).	perennial
Thurovia triflora	$n=5$	Spencer Tomb (Unpublished count).	annual
Xanthocephalum gymnospermoides	$n=6$	Raven et al. (1960), Solbrig (1960), Turner et al. (1962), Dejong & Longpre (1963).	annual
X. humile	$n=4$	Turner et al. (1962).	annual

X. linearifolium	$n=4$	Turner (Solbrig, 1961), Beaman & Turner (1962).	perennial
X. sericocarpum	$n=4$	Dejong & Longpre (1963).	annual
X. wrightii	$n=4$	Solbrig (1961).	annual

Based on morphological and anatomical data and also recent cytological findings, I believe that the most reasonable concept for this complex would be to merge *Xanthocephalum*, *Gutierrezia*, and *Greenella* into one genus and to maintain *Gymnosperma*, *Amphiachyris*, *Amphipappus*, and *Thurovia* as distinct genera. Since *Xanthocephalum* is the earliest name in the group to be merged, it is the correct name for it.

Even though *Thurovia* shares many morphological and anatomical features with members of the *Xanthocephalum* complex, its absence of ray flowers, its style, and its base chromosome number suggest that further biosystematic studies are needed to assess its relationship with *Xanthocephalum*. However, morphological, anatomical, and cytological evidence clearly indicates that *Greenella* and *Gutierrezia* should not be maintained as distinct and show enough unifying characters to be transferred into *Xanthocephalum*.

KEY TO THE GENERA

A. Pappus of disc florets composed of well-developed setae basally united, almost equaling corolla.
  B. Involucre elongate-turbinate; ray florets 1–2; disc florets fewer than 10; pappus of both ray and disc florets composed of well-developed setae; perennial shrubs . . . . . *Amphipappus*
  BB. Involucre broadly campanulate; ray florets more than 5; disc florets more than 10; pappus of ray florets reduced to a low crown; annuals herbs (or possibly short-lived perennials) . . . . *Amphiachyris*
AA. Pappus scaly or reduced to low crown in disc as well as in ray florets.
  C. Ray florets absent . . . . . *Thurovia*
  CC. Ray florets present
    D. Ray corollas shorter than or equal to the disc corollas *Gymnosperma*
    DD. Ray corollas longer than disc corollas . . . . *Xanthocephalum*

GENERIC SYNONOMY

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Odontocarpha DC., Prodr. 5:71. 1836.

ACKNOWLEDGEMENTS

My appreciation is expressed to Dr. Loran C. Anderson for interesting me in this investigation and for giving helpful suggestions during the course of the study and preparation of the manuscript; to Drs. T. M. Barkley, L. C. Hulbert, O. W. Bidwell, and C. W. Shenkel for reading the manuscript and offering suggestions and criticisms; to the late Dr. L. H. Shinners for supplying information on collection sites and for making valuable suggestions in work related to evolutionary relationships among the genera studied; and to Dr. Spencer Tomb for providing unpublished data and valuable advice. Financial support from the Kansas Agricultural Experiment Station and Grant RR-8006, General Research Support Branch, Division of Research Resources, National Institute of Health, is gratefully acknowledged.

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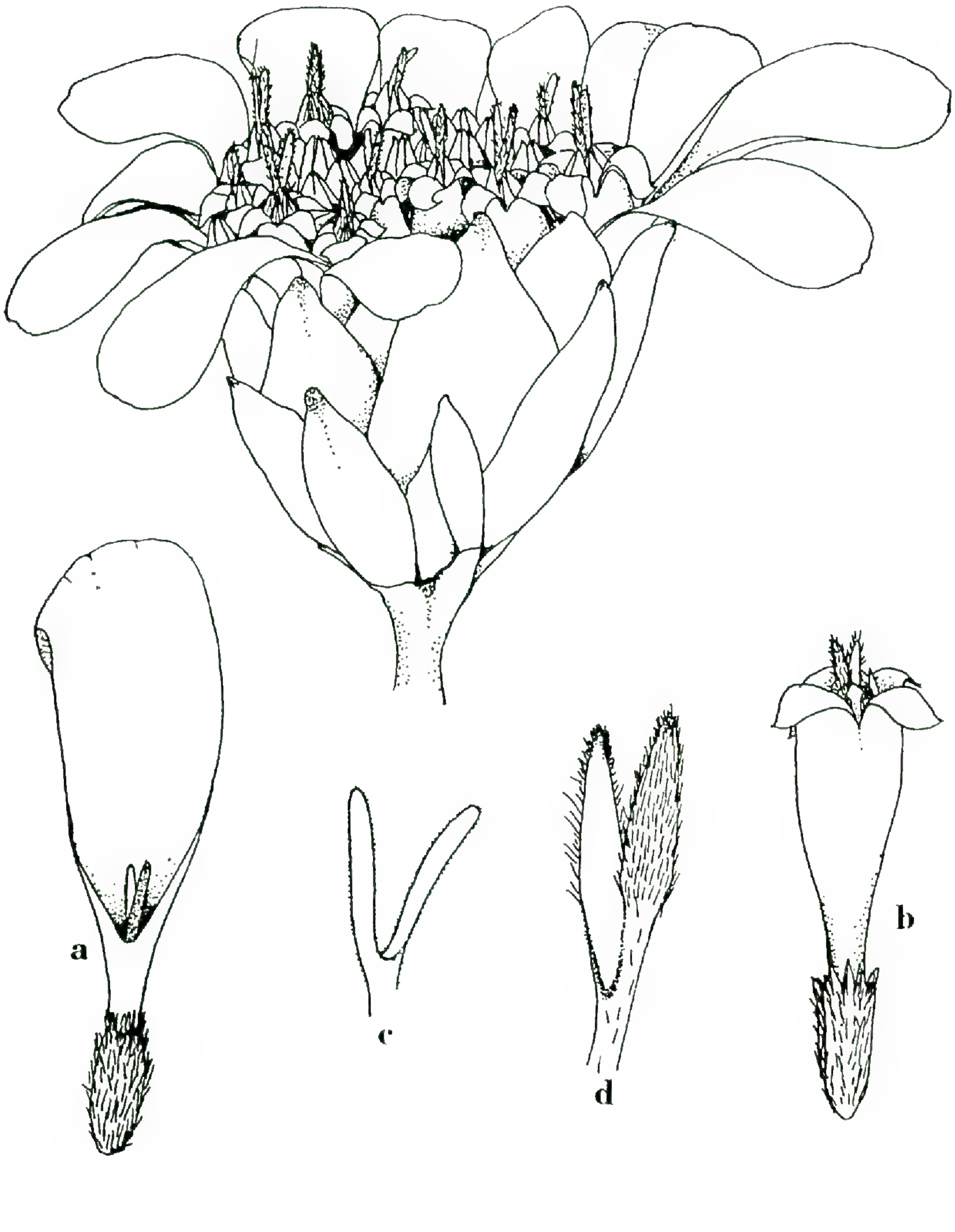


Fig. 1. Flowering head of *Gutierrezia texana* X20: a. Ray flower X16. b. Disc flower X20. c. Style branch of ray flower X30. d. Style branch of disc flower X25.

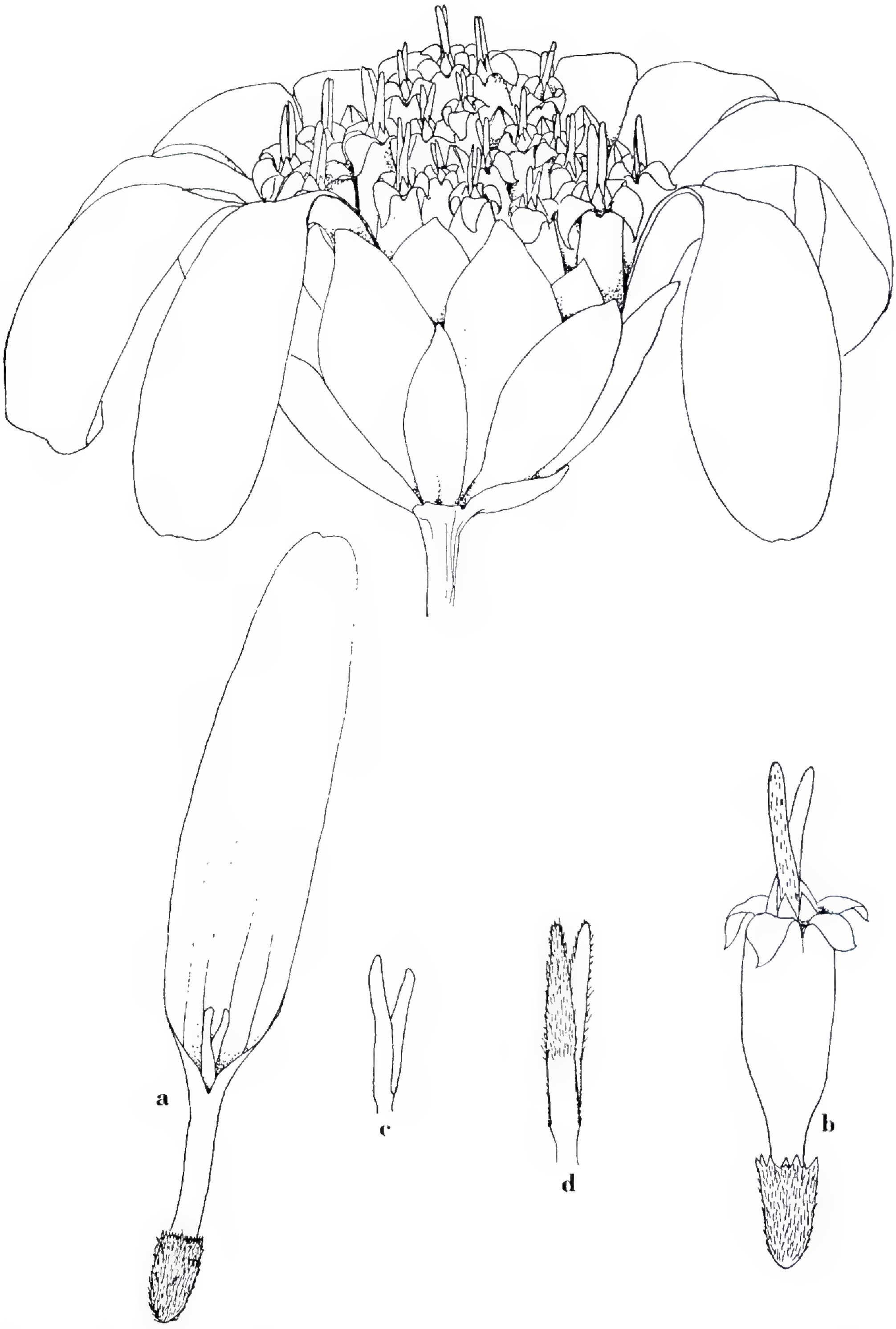


Fig. 2. Flowering head of *Greenella arizonica* X16: a. Ray flower X10. b. Disc flower X10. c. Style branch of ray flower X16. d. Style branch of disc flower X10.

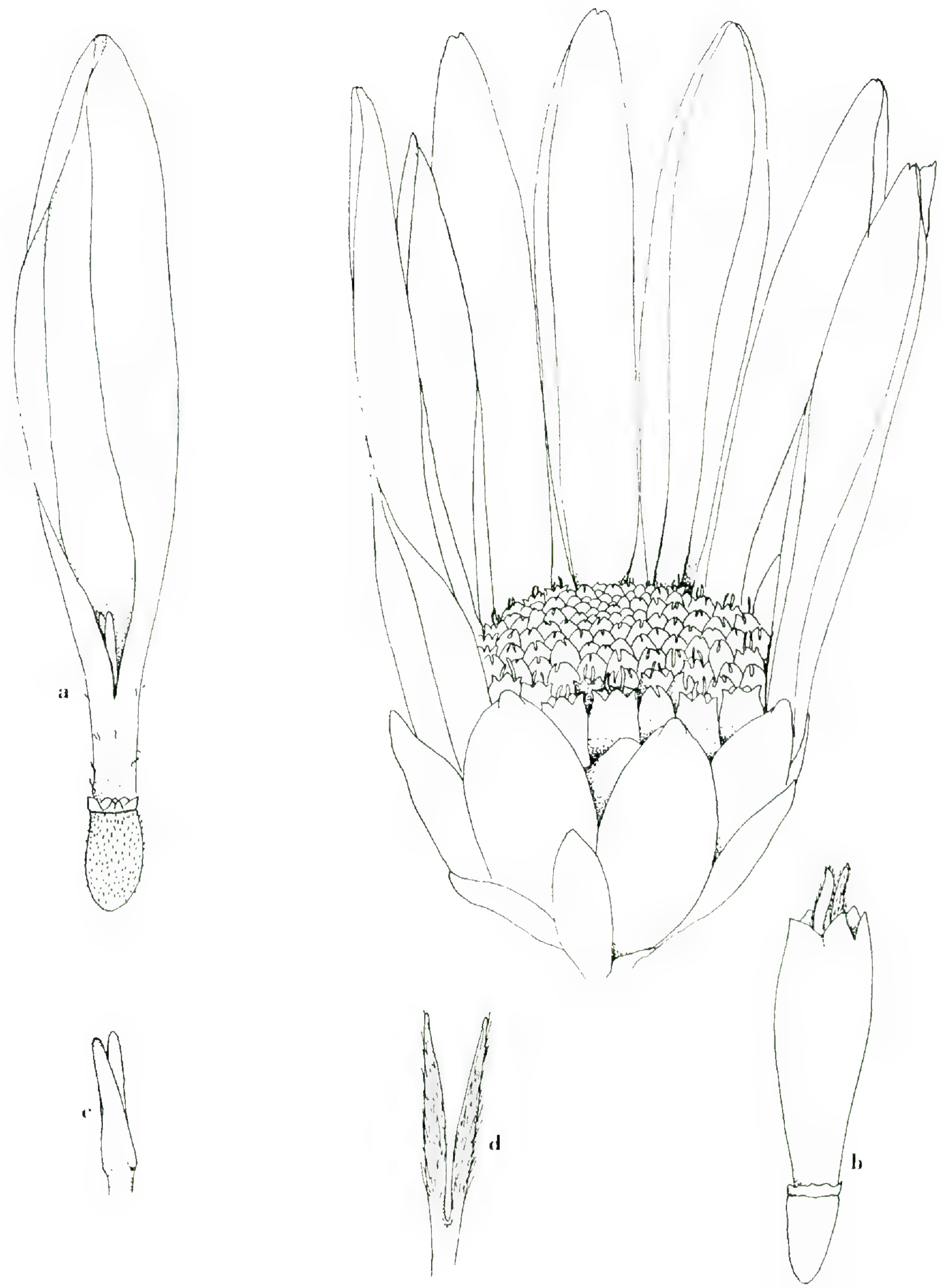


Fig. 3. Flowering head of *Xanthocephalum wrightii* X25: a. Ray flower X10. b. Disc flower. Note the presence of glabrous achene, X10. c. Style branch of ray flower X20. d. Style branch of disc flower X16.

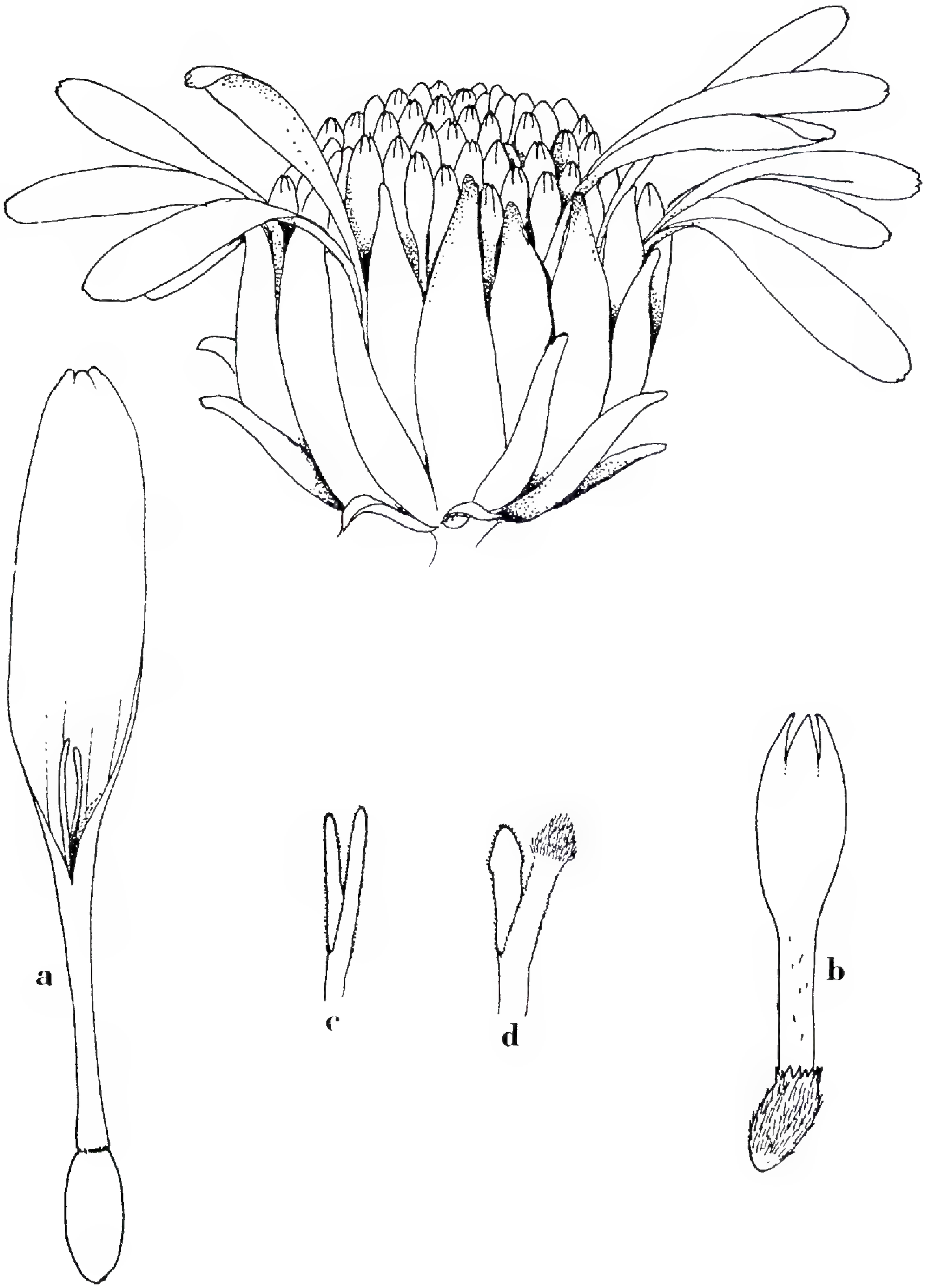


Fig. 4. Flowering head of *Xanthocephalum gymnospermoides* X12: a. Ray flower X12. b. Disc flower X10. c. Style branch of ray flower X16. d. Style branch of disc flower X16.

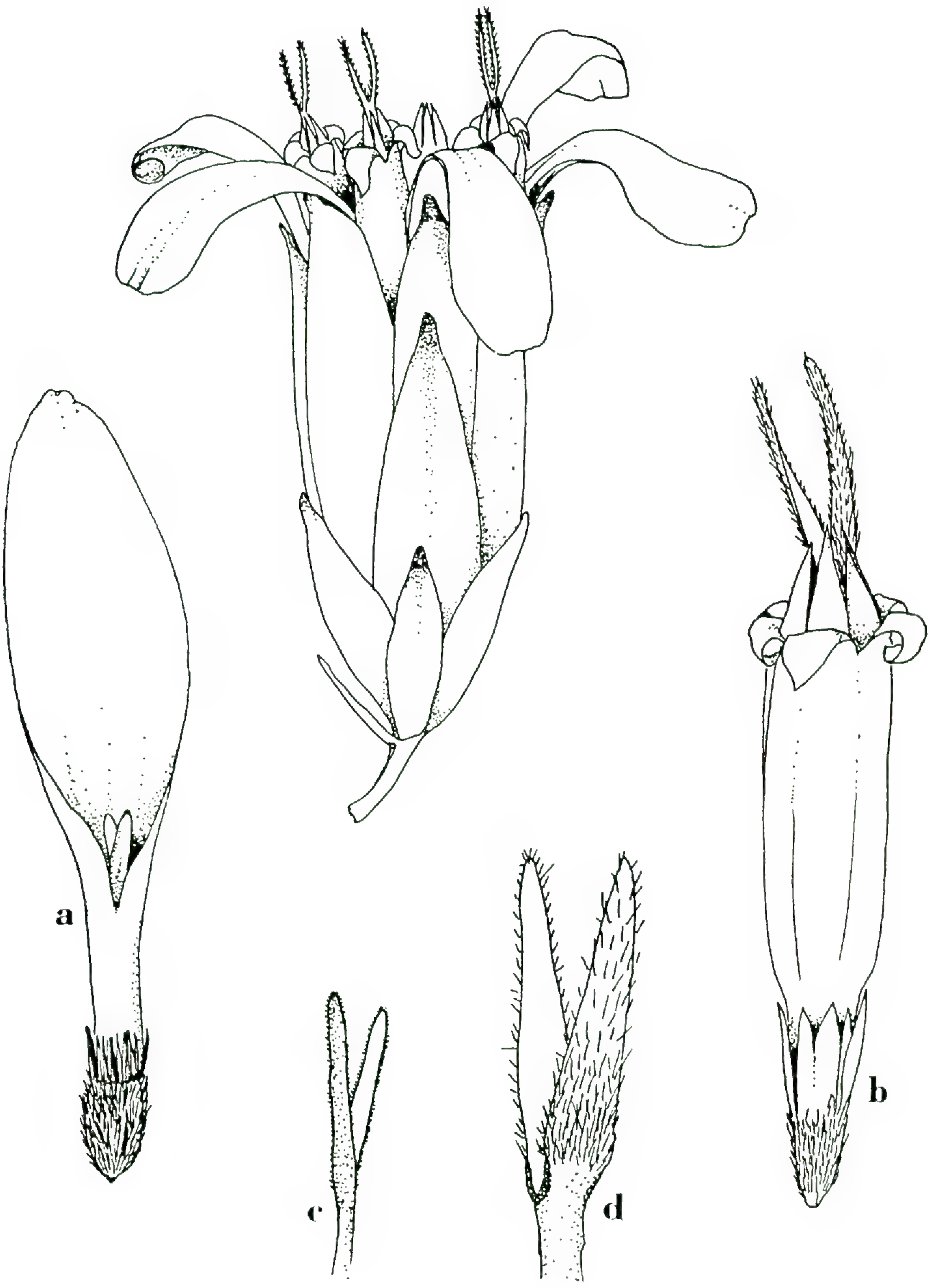


Fig. 5. Flowering head of *Gutierrezia sarothrae* X20: a. Ray flower X20. b. Disc flower X20. c. Style branch of ray flower X25. d. Style branch of disc flower X25.

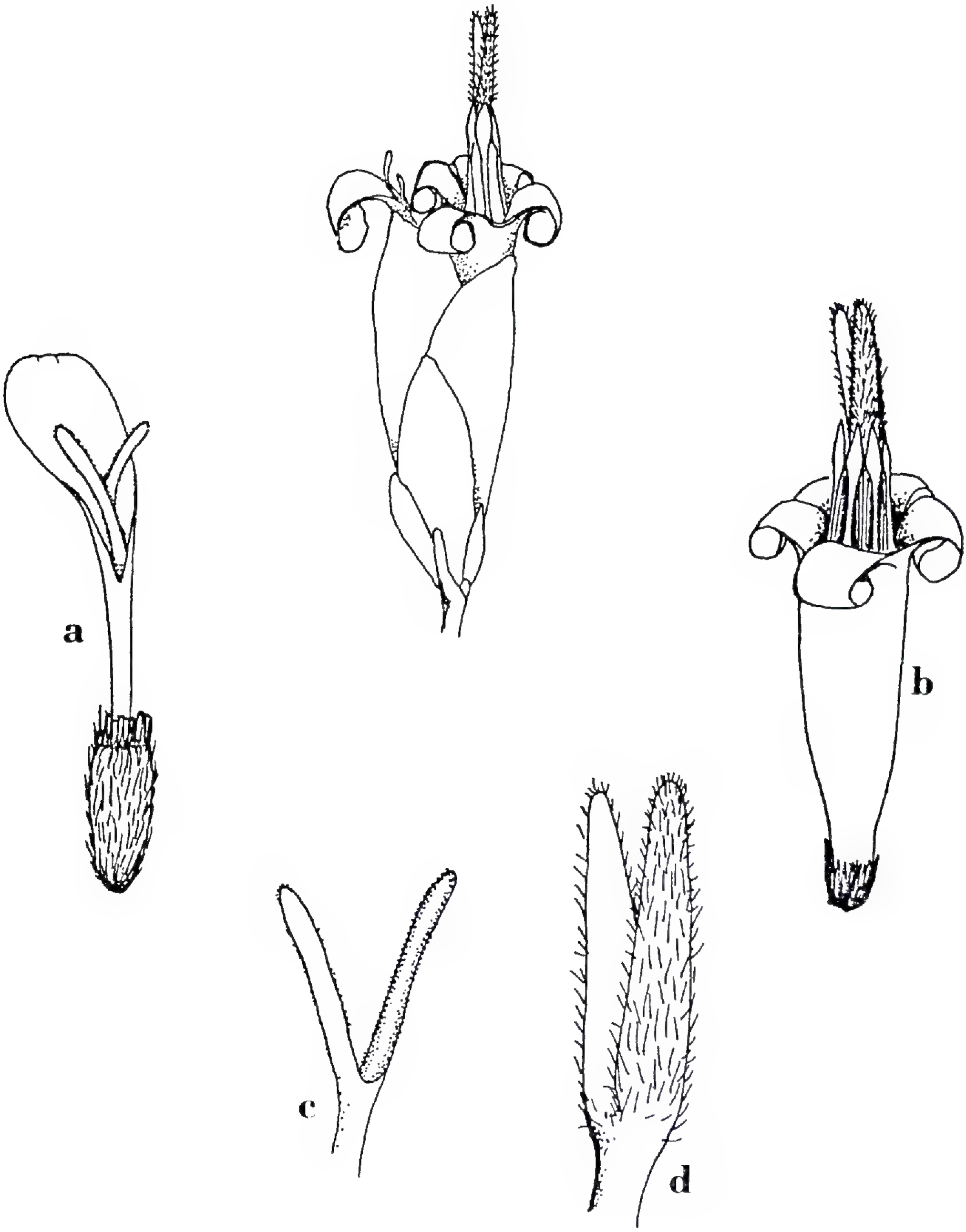


Fig. 6. Flowering head of *Gutierrezia microcephala* X20: a. Ray flower X16. b. Disc flower X20. c. Style branch of ray flower X25. d. Style branch of disc flower X25.

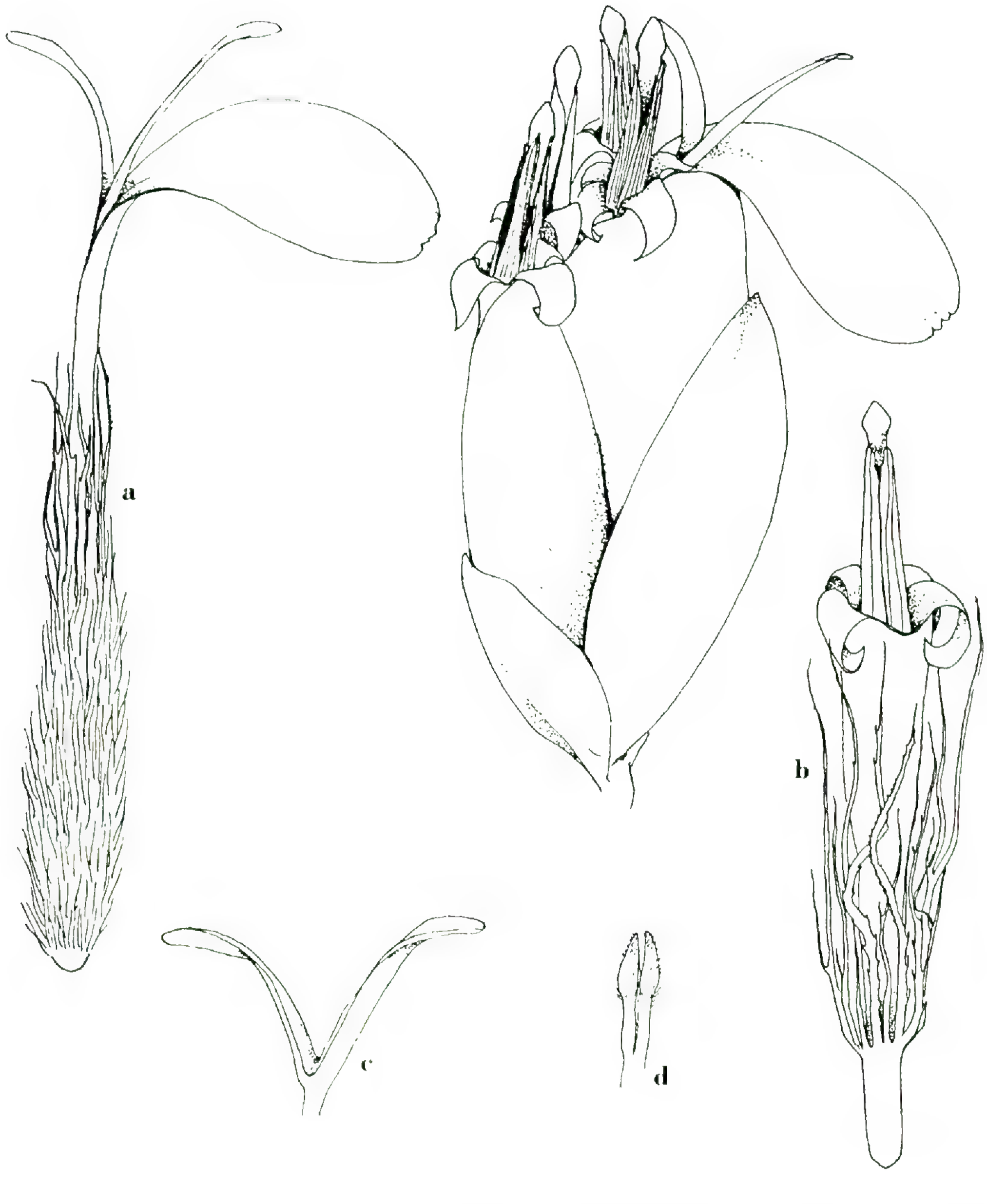


Fig. 7. Flowering head of *Amphipappus fremontii* X20: a. Ray flower X25. b. Disc flower X16. c. Style branch of ray flower X16. d. Style branch of disc flower X25.

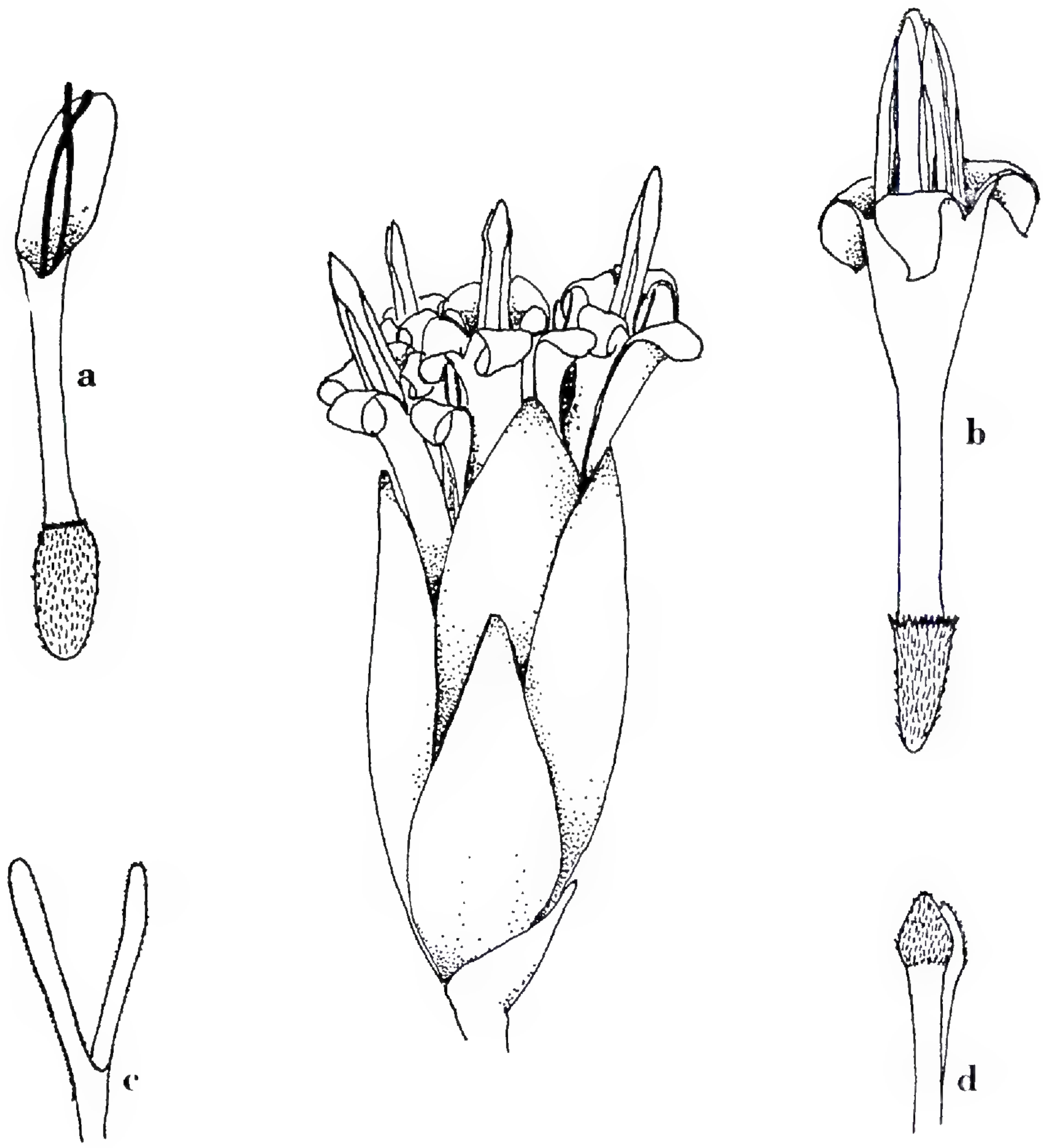


Fig. 8. Flowering head of *Gymnosperma glutinosum* X16: Note ray flowers which do not surpass the tubular ones giving the head a discoid appearance: a. Ray flower X20. b. Disc flower X20. c. Style branch of ray flower X25. d. Style branch of disc flower X20.

Fig. 9. Flowering head of *Amphiachyris dracunculoides* X20: a. Ray flower X30. b. Disc flower X25. c. Style branch of ray flower X30. d. Style branch of disc flower X25.

Fig. 10. Flowering head of *Amphiachyris amoenum* var. *intermedium* X16: a. Ray flower X16. b. Disc flower X20. c. Style branch of ray flower X20. d. Style branch of disc flower X25.

Fig. 11. Flowering head of *Amphiachyris amoenum* var. *amoenum* X16: a. Ray flower X16. b. Disc flower X20. c. Style branch of ray flower X20. d. Style branch of disc flower X20.

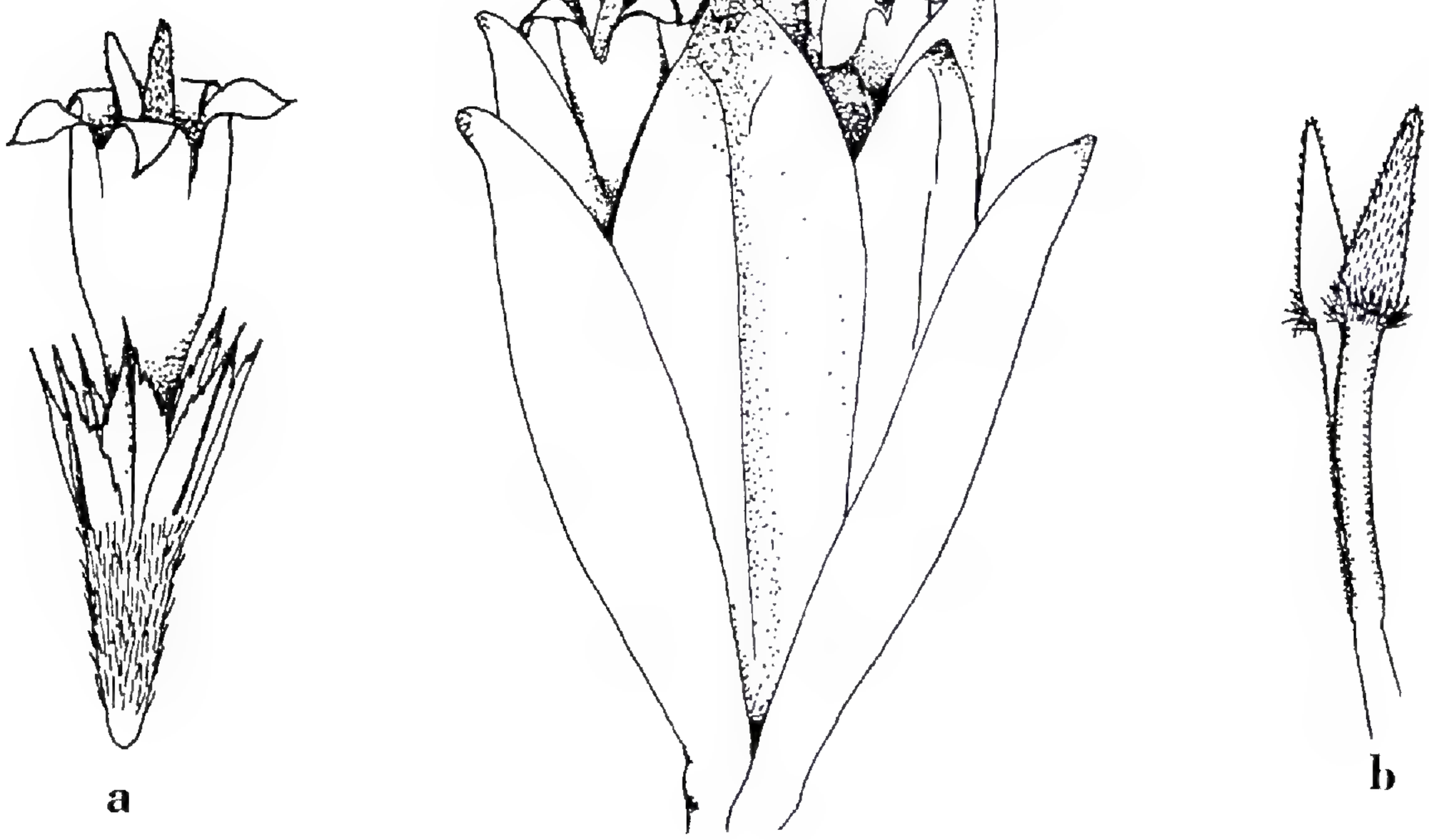
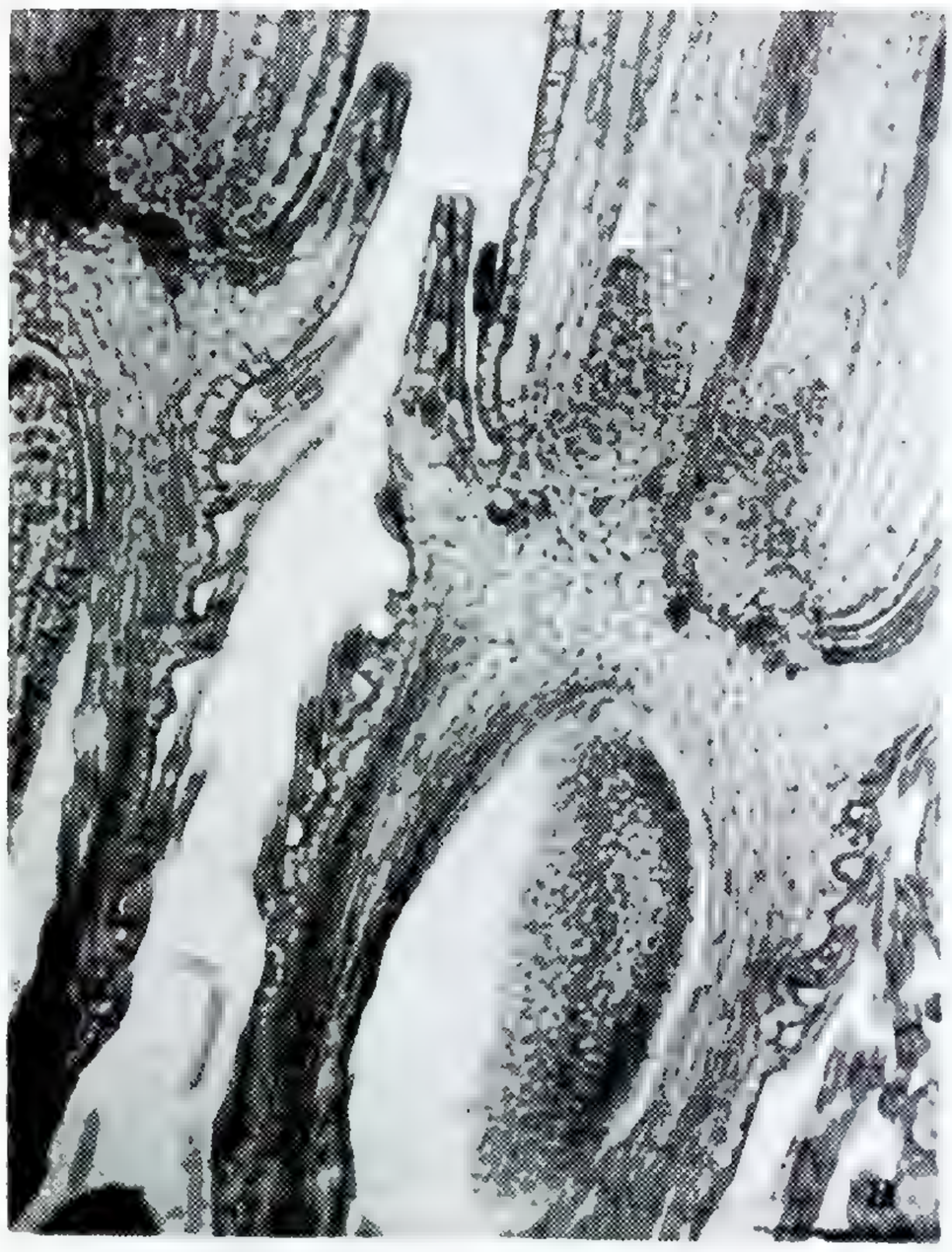
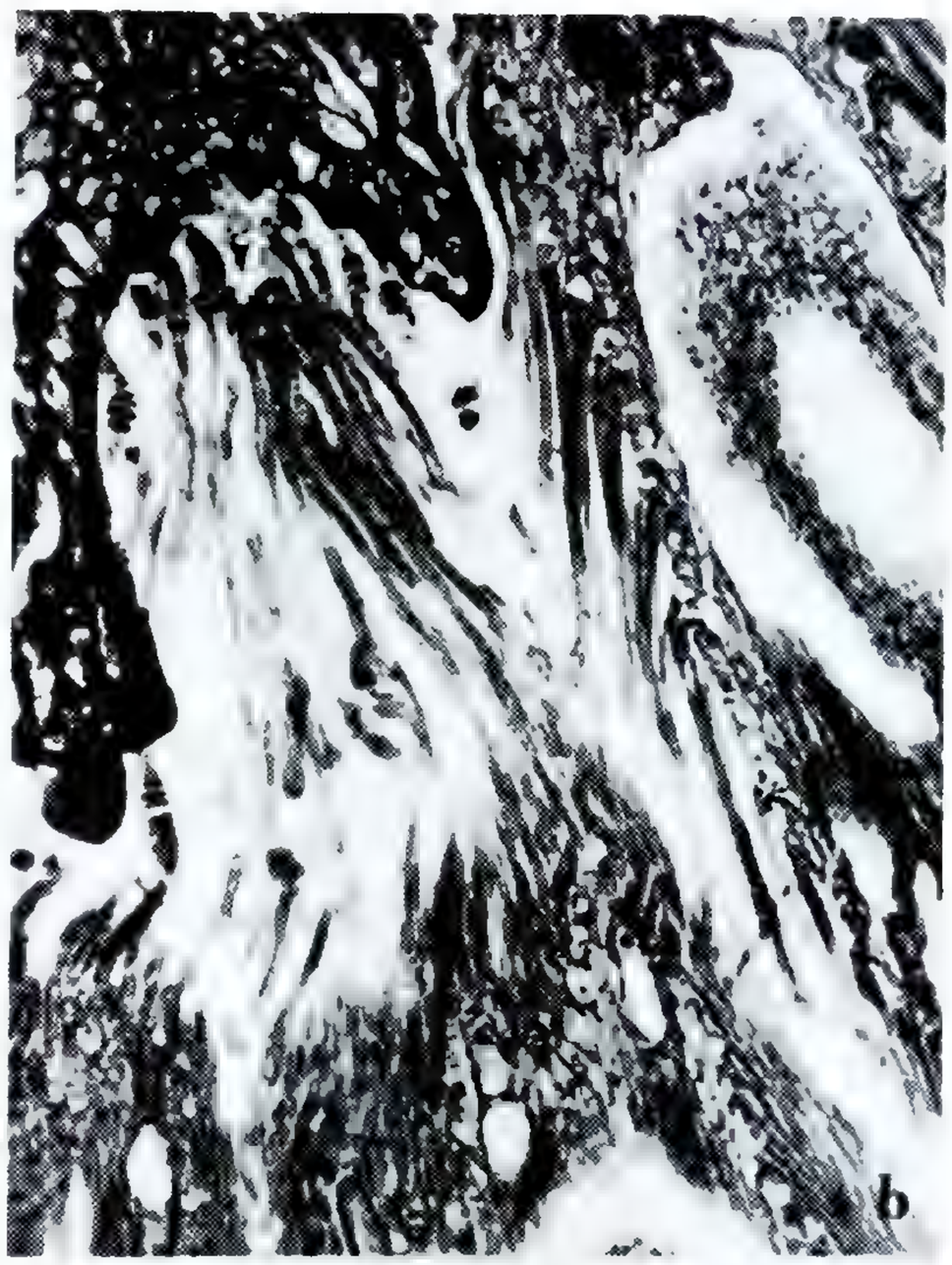


Fig. 12. Flowering head of *Thurovia triflora* X20: a. Disc flower X16. b. Style branch of disc flower X16.

Fig. 13. Leaf shape and venation. Only major veins are drawn: a. *Xanthocephalum linearifolium*. b. *X. gymnospermoides*. c. *X. wrightii*. d. *X. centauroides*. e. *X. sericocarpum*. f. *Gymnosperma glutinosum*. g. *Greenella arizonica*. h. *Thurovia triflora*. i. *Amphipappus fremontii*. j. *Gutierrezia sarothrae*. k. *G. taltalensis*. l. *Amphiachyris dracunculoides*. m. *A. amoenum* var. *intermedium*.





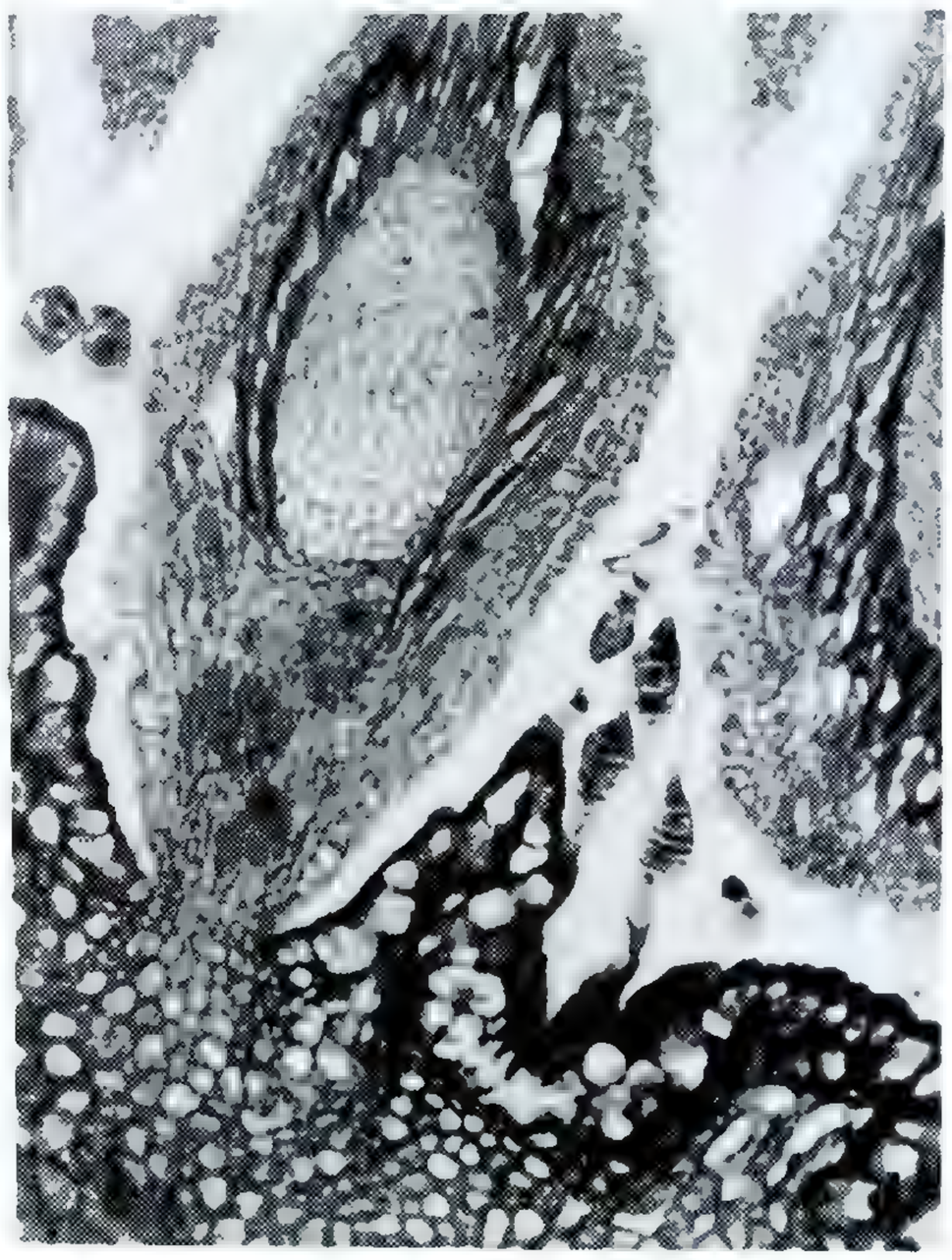
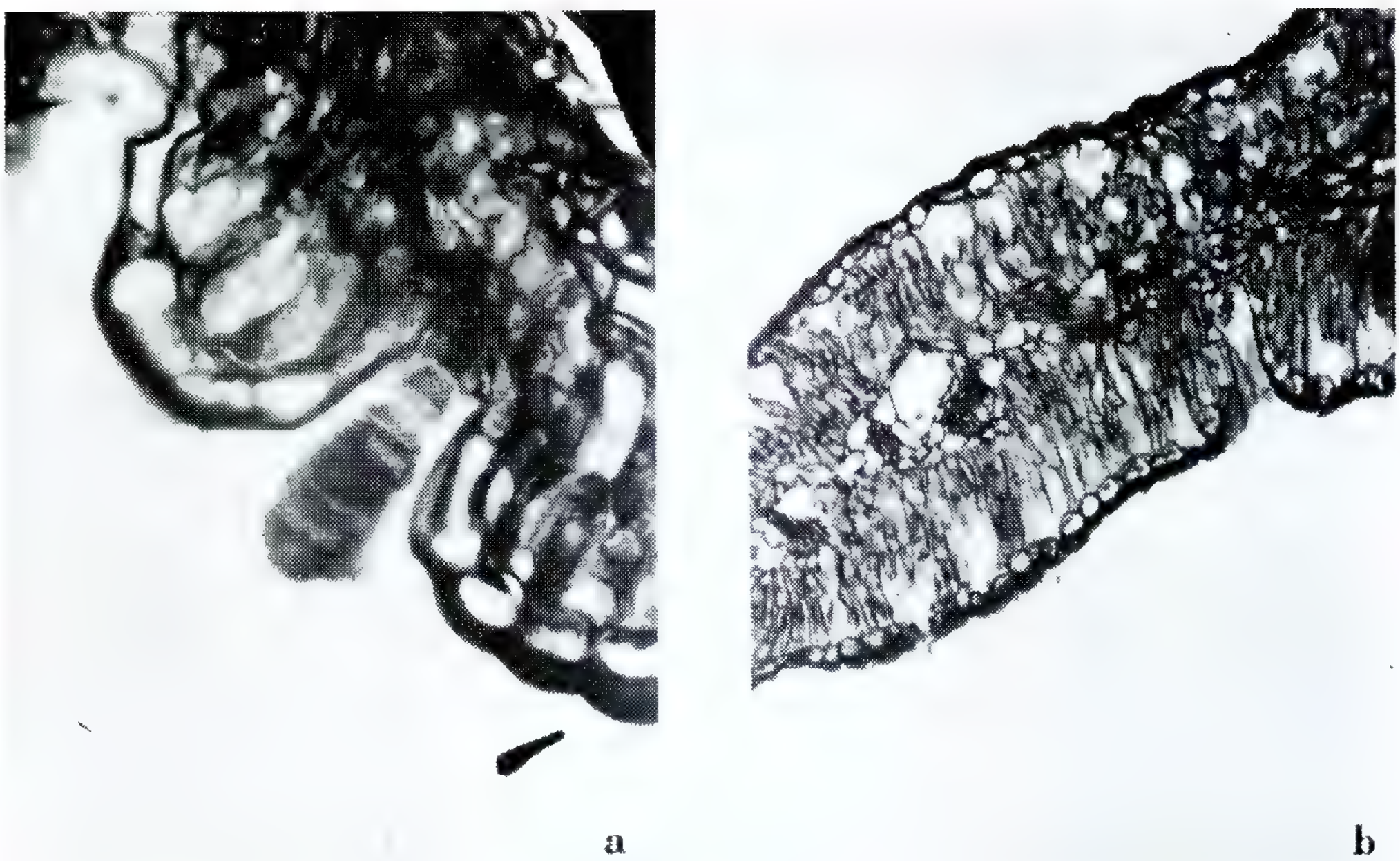


Fig. 14. Longitudinal sections: a. *Xanthocephalum gymnospermoides* flower showing biseriate non-glandular "zwillingshaar" trichomes. Note trichomes are situated on "mounts" originating on the wall of the achene. Also note nectary glands surrounding the style base, X89. b-d. Hook-like receptacular glands: b. *Gutierrezia texana,* X89. c, *Greenella arizonica,* X351. d. *Xanthocephalum wrightii,* X89.

Fig. 15. a. Longitudinal section of *Xanthocephalum humile* flower showing abundant occurrence of glandular trichomes along lower half of corolla tube, X89. b. Cross-section of *Gutierrezia texana* stem showing trilacunar nodal structure, X89. c. *Xanthocephalum wrightii* ray cross-section showing papillate epidermal ray cells and secretory canals adaxial to each vascular bundle, X89. d. *Greenella ramulosa* showing vascular bundle with conspicuous secretory canal. Note strong alignment of involucral bracts, X89.



a b

Fig. 16. Leaf transections showing the presence of glands within cavities: a. *Gutierrezia texana*, X351. b. *Gymnosperma glutinosum*, X89.

FURTHER COMMENTS ON STYRAX L.

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In his recent monograph of *Styrax* (Sida 5: 191-258. 1974) Gonsoulin treated the species from the Lesser Antilles in such a way as to require comment and correction in relation to my own work on the flora of the islands. Curiosity prompted the checking of one other taxon with the result that a new combination is proposed. I leave it to others to note these suggestions and to check the work further.

Gonsoulin failed to explain his treatment of the gender of the name *Styrax* and was not consistent in the specific epithets used. In many cases the original spelling is altered without noting such changes. *Styrax* has been and can be treated as masculine, feminine, or neuter. However, Wood and Channell made a recommendation in a paper cited by Gonsoulin (Jour. Arnold Arb. 41: 1-35. 1960) on which he offered no comment. Wood and Channell pointed out that Linnaeus consistently treated the name as neuter and that, under Recommendation 75A (1) of the *International Code of Botanical Nomenclature*, Linnaeus' practice in this matter should be followed. The following neuter endings are preferred: *Styrax americanum*, *S. grandifolium*, *S. argentum*, *S. conterminum*, *S. obtusifolium*, *S. ochraceum*, and *S. glabrum*. It should be pointed out that general agreement on the gender to be used does not exist in even more recent practice. Entry 11/06408 in the *Index Nominum Genericorum* acknowledged the type species of *Styrax* to be "*S. officinalis* L. (*'officinale'*)." Stearn (Bot. Latin 76. 1966) stated that the generic name *Styrax* is treated as feminine. Airy-Shaw (Willis' Dict. Fl. Pl. and Ferns, 8th ed., 1116. 1973) referred to "*Styrax officinale*." The recommendation of the *International Code of Botanical Nomenclature* to follow "general usage" can best be implemented by following the practice of the original author Linnaeus.

In reference to the species in the Lesser Antilles, the editorial style adopted by Gonsoulin is confusing and misleading. Swartz (Nov. Gen. Sp. Pl. Prodr. 74. 1788) published *S. glabrum*, not *S. glaber* as used by Gonsoulin (op. cit. 233). In 1788, Cavanilles also published the same binomial as "*Styrax glabrum* Lamarck," an illegitimate substitute for *S. americanum* (Encycl. Meth. 1: 82. 1783). Gonsoulin correctly listed the Cavanilles binomial in the synonymy of *S. americanum* but cited incorrectly the publication date as 1790. Although "*Styrax glabrum* Cav." is illegitimate, a fact unnoted by Gonsoulin, the problem of two different uses of the same binomial in 1788 is easily settled by reference to Stafleu's *Taxonomic Literature* (Reg. Veg. 52: 79, 462. 1967). The pertinent fascicle of Cavanilles' *Monodelphia classis dissertationes* decem 6: page 340, plate 188, fig. 1 was published between Octo-

SIDA 5(5): 334—337. 1974.

ber 12 and 25, 1788, while Swartz' *Prodromus* was published in July of the same year.

In the synonymy of *S. glabrum* Sw., Gonsoulin attributed the binomial *S. occidentalis* to Swartz ex Thunberg. This name also might have been indicated as illegitimate, as it was proposed in a thesis defended by L. J. Prytz, a student of Thunberg, when he noted the existence of *S. glabrum* Cav. and renamed *S. glabrum* Sw. as *S. occidentalis* Swartz. Why the name was attributed to Swartz is not clear. The citation of Swartz ex Thunberg is correct.

To the synonymy of *S. glabrum* Sw. should be added *Morisonia imrayi* Griseb. (Fl. Brit. W. Ind. 19. 1859). Grisebach cited an Imray collection (K) from Dominica, and Urban noted this misidentification by Grisebach in a comment following the description of *S. portoricensis* (Bot. Jahrb. 15: 338. 1892).

The designation of a holotype for *S. glabrum* Sw. also requires some comment, for Gonsoulin, possibly influenced by Urban's citation of this record (op. cit.), has indicated it to be "Willdenow 8326." However, Willdenow 8326 is the number of an herbarium entry, actually two sheets, in the Willdenow herbarium (B) and not a specimen collected by Willdenow. Neither sheet should be designated as the holotype. In the original publication of the species, Swartz (Prodr. 74. 1788) stated "India occidentalis, Vincenti" with the classical symbol for a perennial or woody plant. Swartz later elaborated on the description and stated (Fl. Ind. Occident. 2: 848. 1800) "Habitat in India occidentali; Ins. Sti Vincentii (Anderson)." Such a specimen from the island of St. Vincent, where Anderson was superintendent of the Botanical Garden from 1785-1811, is in the herbarium of the British Museum (Natural History). This is the holotype. There are two sheets in the Willdenow herbarium as seen on microfiche (IDC 7740. 567. III. 1,2), the first a specimen with flowers and the second a sterile specimen of but two leaves. Both specimens bear comparable labels mentioning the Swartz *Prodromus* page 74 and the habitat of "India occidentalis," and both were annotated by Perkins. The index to the Willdenow Herbarium on microfiche (IDC 7740. 27. III. 7) suggested with a question mark that the specimens might have come from the Vahl herbarium. The flowering specimen with its shortly acute to subtruncate leaf apices appears to be a good match for a specimen collected by Ryan on Montserrat and deposited in the herbarium at Copenhagen. The questioned reference to Vahl's herbarium may be accurate.

Several errors of geography are also found in Gonsoulin's citations. Bains-Jaunes, not "Bains-Tames," is the classical collecting locality in Guadeloupe. "Herbier de la Martinique" is not a locality but a label heading. Duss collections cited under this title present other problems, for many specimens from different localities were distributed under the same number. Duss himself (Fl. Phan. Ant. Franc. 389. 1897) noted that his collection 1728, a collection cited by Gonsoulin, was found in the "Bois de la Calebasse, de l'Ajoupa-Bouillon, de Fontaine-Chaude, de Case-Pilote." In other cases a single Duss number may represent a mixed collection, or two or more

numbers may be given to a single specimen. Even a single location on a given herbarium label may vary from one herbarium to another and so can not be trusted. The Cowan collection from Tobago was made "Roxborough-Parlatuvier Road, Main Ridge: primary forest, 450-500 m. elev."—not at "Orxborough," which is an unfortunate typographical error.

Gonsoulin's description of *S. glabrum* does not cover the full range of variation in the size and shape of the leaves of the species. He apparently followed the descriptions given by Urban (Bot. Jahrb. 15: 338. 1892) and Perkins (Pflanzenr. IV, 241: 63. 1907) but did not mention that both authors noted that their descriptions do not agree with that given by Swartz. Swartz described the leaves as lanceolate-oblong, acuminate, and subserrate to entire. The holotype has such characteristics, and I suspect this leaf shape is associated with vigorous shoots. Other specimens from the Lesser Antilles have shorter, elliptical to ovate leaves with apices acute to rounded or subtruncate. A single specimen labeled Duss 3262/3707 (P) from Guadeloupe has fruit twice the size described by previous authors. Specimens have also been seen from the islands of St. Kitts (*Howard 16588* [A], *Wadsworth 495* [A]), Montserrat (*Squire s.n.* [A], *Ryan s.n.* [C]), and Dominica. The occurrence of *S. glabrum* on Dominica was mapped by Gonsoulin but no specimens were cited. The Imray collection originally described as *Morisonia* documents such a record. It is possible that two species are represented in the Lesser Antilles but only a few fruiting specimens are available and no material of flower and fruit from the same individual plant or population is available. *Styrax glabrum* of the Lesser Antilles requires further study and careful examination in the field.

Gonsoulin listed as a generic synonym of *Styrax* the name *Darlingtonia* Torrey, but he apparently failed to see an additional complication in this reference which affects the nomenclature he adopted. In 1851, Torrey (Proc. Amer. Assoc. Adv. Sci. 4: 190-193) described a new plant collected by Fremont in California for which he proposed the name *Darlingtonia rediviva.* In 1853, Torrey (Smithsonian Contr. Knowl. 6(4): 1-8, pl. 12) described the insectivorous genus *Darlingtonia* with one species, *D. californica.* The generic name had been used earlier by A. P. de Candolle and its use by Torrey for the insectivorous plant has been conserved (3131). In the 1853 paper, Torrey stated: ". . . a Californian plant, on imperfect specimens of which, I had recently indicated a genus under this name, proves to be only a species of *Styrax.*" Torrey then stated in a footnote: "Having recently obtained good flowering specimens of this plant, the following description of it is *appended: -Styrax californicum* . . . ." [Emphasis added.] The binomial *Darlingtonia rediviva* remained in limbo until L. C. Wheeler reviewed the matter (Bull. S. Calif. Acad. Sci. 44(3): 94. 1945) and made the combination *Styrax rediviva* (Torrey) L. C. Wheeler. This new combination was overlooked by Gonsoulin and is not considered in recent floras of California. If a variety is to be recognized (as Gonsoulin and Rehder recognized var.

californica), then the correct name, citation, and synonymy are the following:

Styrax officinale L. var. **rediviva** (Torrey) Howard, comb. nov.

Darlingtonia rediviva Torrey, Proc. Amer. Assoc. Adv. Sci. 4: 190-193. 1851.

Styrax rediviva (Torrey) L. C. Wheeler, Bull. S. Calif. Acad. Sci. 44(3): 94. 1945.

Styrax californicum Torrey, Smithsonian Contr. Knowl. 6(4): 1-8, pl. 12. 1853.

Styrax officinalis var. *californica* (Torrey) Rehder, Mitt. Deutsch. Dendrol. Ges. 1915: 226. 1915.

POLLEN MORPHOLOGY OF AMPHICARPAEA (LEGUMINOSAE: PHASEOLEAE)

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This study concerns itself with the determination of the pollen characteristics of the members of the genus *Amphicarpaea*. Based on the external morphology of the members of the genus *Amphicarpaea*, Turner and Fearing (1964) regarded the genus as consisting of three valid species, *A. africana* (Hook.) Harms., *A. bracteata* (L.) Fern. and *A. edgeworthii* Benth. Each of these species exists on a different continent, *A. africana* from Africa, *A. bracteata* from North America, and *A. edgeworthii* from Asia. It was also pointed out that *A. bracteata* and *A. edgeworthii* are often quite difficult to distinguish based on external characteristics.

MATERIALS AND METHODS

The pollen samples were prepared using the standard acetolysis method devised by Erdtman (1952, 1960). The filtration of pollen was performed during the first washing after acetolysis. The pollen grains were mounted in glycerin and sealed with paraffin.

RESULTS

The pollen grains of *Amphicarpaea africana*, *A. bracteata* and *A. edgeworthii* were found to exhibit distinctly different characteristics. All species had spherical grains, but differed with regard to texture of the sexine and colpi-ora characteristics. Pollen characteristics of specimens previously identified as *A. comosa* were also examined and found to have pollen characteristics identical to *A. bracteata*.

The pollen characteristics for the three species of *Amphicarpaea* are as follows:

A. africana (Fig. 1)

Spherical, tricolporate, zonotrene ora, reticulated sexine, blending into smooth regions near the colpi, diameter ca. 30μ. (Uganda: Taylor 2845, ISC; Tanzania: Richards 24654, NY)

A. bracteata (Fig. 2)

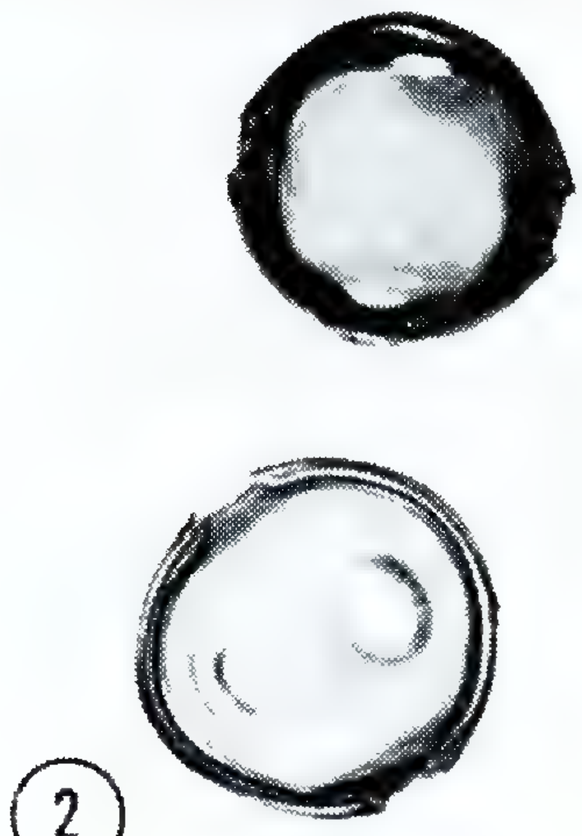
Spherical, tetraporate, zonotrene ora, smooth sexine, ora slightly raised or lipped, diameter ca. 28μ. (U.S.A.: Demaree 16228, SMU; Kral and Godfrey 3562, SMU)

A. edgeworthii (Fig. 3)

Spherical, triporate, zonotrene ora, smooth sexine, ora slightly raised or lipped, diameter ca. 28μ.

SIDA 5(5): 338—340. 1974.

1



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3

Figs. 1-3. 1. Pollen grain of *Amphicarpaea africana*. Note reticulation and colpora. X 1600. 2. Pollen grain of *A. bracteata*. Note number of pores. X 1600. 3. Pollen grain of *A. edgeworthii*. Note number of pores. X 1600.

(Japan: Charette 1401, MO; Kirkino 24104-364, SMU)

DISCUSSION AND CONCLUSION

The pollen grain morphology supports the results obtained by Turner and Fearing (1964). There are only three distinct species of *Amphicarpaea* based on pollen morphology. In regard to the relationship of these three species, it could be hypothesized that *A. africana* possesses pollen most similar to

that of the precursor of the genus because it possesses a primitive tricolporate grain with a reticulated sexine. The other species, *A. bracteata* and *A. edgeworthii*, appear to be modifications of this basic form by loss of the colpi and reticulated sexine and an increase or retention in the number of pores. This supports the statement made by Turner and Fearing (1964) that *A. africana* is "a very distinct species being more distant from *A. edgeworthii* and *A. bracteata* than the latter taxa are from each other." In fact, the external characteristics of *A. bracteata* and *A. edgeworthii* are so similar that Turner and Fearing (1964) stated: "The taxa are almost identical and even the technical characters listed in the key to the species often fail to place an occasional specimen. If it were not for their continental isolation, the taxa would probably have been treated at no more than varietal rank." Although the pollen shows similar characteristics for these species, it also indicates that they are distinctly different.

On the basis of pollen morphology, the species can be distinguished as follows:

1. Pollen tricolporate . . . . . *A. africana*
1. Pollen porate.
   2. Pollen tetra-pentaporate . . . . . *A. bracteata*
   2. Pollen triporate . . . . . *A. edgeworthii*

Using the pollen characteristics in conjunction with the external morphology, the members of the genus *Amphicarpaea* can be definitively identified.

ACKNOWLEDGEMENTS

I would like to thank Dr. Wm. F. Mahler for his continuous guidance while preparing the specimens and the manuscript and Dr. Joan Nowicke for her suggestions and comments.

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TURNER, B. L. and FEARING, O. S. 1964. A taxonomic study of the genus *Amphicarpaea* (Leguminosae). The Southwestern Naturalist. 9(4):207–218.

WOOD ANATOMY OF AMPHIACHYRIS, AMPHIPAPPUS, THUROVIA, GYMNOSPERMA, AND THE XANTHOCEPHALUM COMPLEX

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The problem of delimiting *Amphipappus*, *Amphiachyris*, *Greenella*, *Gutierrezia*, *Gymnosperma*, *Xanthocephalum*, and *Thurovia* (Compositae) has been reviewed by Gray (1873), Bentham and Hooker (1873), Rose (1895), Nelson (1934), Porter (1943), Shinners (1950), Solbrig (1960), Correll and Johnston (1970), and Ruffin (1971). Unfortunately, the phylogenetic relationship of the genera is still an open question. This is the second paper in a multiphase investigation intended to assemble new evidence toward a more satisfactory taxonomic treatment of the genera. Comparative morphological and anatomical studies—of ray and disc florets, phyllaries, receptacle, achene, pappus, style, and leaves—and recent cytological findings reported in the previous article (Ruffin, 1971) disclosed evidence favoring the merger of the previous distinct *Xanthocephalum*, *Gutierrezia*, and *Greenella* into one coherent genus and maintaining *Gymnosperma*, *Amphiachyris*, *Amphipappus*, and *Thurovia* as distinct genera. *Xanthocephalum*, the earliest name in the group merged, is used throughout this report to include the previously distinct genera.

Although the details of wood anatomy presented here are by no means conclusive it is hoped that they will be of value in properly interpreting the limits of and evolutionary relationship among the genera.

MATERIALS AND METHODS

Most wood samples were sectioned between 15-20 microns on a sliding microtome and were stained with safranin or with safranin and fast green with tannic acid followed by ferric chloride. When material allowed, macerations were made using Jeffrey's 10% chromic acid-10% nitric acid solution for those wood features difficult to measure from sectioned material. For wood samples taken from herbarium sheets, 71 measurements were made from each collection except *Xanthocephalum ramulosa* and *X. linearifolium* where only 51 were made due to inadequate longitudinal sections. *Thurovia triflora* lacked wood rays; thus other wood features totalled 51 measurements. Wood averages from field material represent 20 measurements for each character, with the exception of widest vessel diameter, taken from two individuals in each population. In all, 4,697 measurements were made.

In order to measure characters such as average diameter of vessels,

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average number of vessels per group, average length of vessel elements, etc., where there are many measurable elements per section, a random sample of such elements was measured. A starting point for scanning a slide was chosen by using random coordinates on the mechanical stage. Moving the slide horizontally (from right to left), I scanned the microscope field between two major lines on an ocular micrometer. Each element measured was given an arbitrary reference point. Whenever these arbitrary points fell within the two lines on the ocular scale, those characters were measured or counted.

OBSERVATIONS AND RESULTS

Table 1 summarizes qualitative and quantitative features for the species studied. Tables 2 thru 9 present a summation of quantitative characters in each of the genera. *Xanthocephalum ramulosum* and *X. linearifolium* have been omitted from Table 1 because of reasons stated elsewhere. However, those features that could be measured are included in the averages of the various genera. In addition, features not included in the tables will also be discussed.

Vessels. Although I did not attempt to determine the exact frequency of vessels seen in a transection, vessels appear to be very numerous in most species of *Xanthocephalum* (*X. gymnospermoides*, *X. sarothrae*, *X. microcephalum*, *X. texanum*, *X. wrightii*). The vessels are also distributed in radial rows in the majority of *Xanthocephalum* species studied. *Xanthocephalum sericocarpum* shows some tangential pairs, a few solitary vessels, and a few short radial rows. In *X. microcephalum* and *X. sarothrae*, solitary vessels as well as long radial chains are present. A significant condition in the latter two species is a tendency toward ring porosity. In each species the ring-porous condition takes the form of more numerous and larger vessels in the late wood (Fig. 1). Also noteworthy is the presence of vascular tracheids in the latter two species.

Extensive grouping of vessels also characterizes most *Xanthocephalum* species. In a number of instances as many as 12 vessels per group were seen. In those members of the genus showing the ring-porous condition, the early wood exhibit smaller numbers of vessels per group whereas the late wood show extreme grouping. Vessel grouping is, however, less extensive in *X. centauroides*, *X. mandonii* spp. *mandonii*, and *X. sericocarpum*. Vessels in the latter species are in groups of two to eight, mostly two to five.

In *Amphiachyris*, vessels appear numerous in all species. Distribution and amount of vessel grouping are diverse and not so extensive as in most species of *Xanthocephalum*. This genus is characterized by solitary vessels, short radial rows of two to six vessels, and some tangential pairs. *Amphiachyris amoenum* var. *amoenum* and *A. amoenum* var. *intermedium*, in every population studied, tend toward a ring-porous condition. Both have been described as annuals, but a simple type of growth ring is represented in which growth appears to be accompanied by diminution in diameter of

Table 1. Comparative features of the wood in Amphiachyris, Amphipappus, Gymnosperma, Thurovia, and Xanthocephalum

Species	Age	Collection	diameter of widest vessel μm	average diameter of vessels μm	average length of vessel elements μm	average diameter of libriform fibers μm	average length of libriform fibers μm	fiber dimorphism	ray crystals	average height of multiseriate rays, mm	ray cells isodiametric to procumbent	ray cells isodiametric to erect	average number cells of maximum ray width
Amphiachyris amoenum													
var. *amoenum*	2?	Ruffin 7033	62.5	34.6	165.7	11.5	397.1	+	—	1.3	+	+	3.7
	3?	Ruffin 7034	57.5	37.0	167.6	11.6	425.5	+	—	1.5	+	+	4.0
	2?	Ruffin 7035	66.0	33.0	185.5	11.9	453.3	+	—	1.4	+	+	3.5
A. amoenum var.													
intermedium	2?	Ruffin 7030	62.5	38.0	176.2	11.1	424.4	+	—	1.6	+	+	4.0
	2?	Ruffin 7031	67.5	35.7	185.3	10.8	413.4	+	—	1.3	+	+	3.8
	2?	Ruffin 7032	72.5	42.0	156.1	11.6	431.5	+	—	1.1	+	+	4.3
A. dracunculoides	1	Ruffin 7036	55	37.3	119.0	13.2	455.2	+	—	.985	+	+	3.2
	1	Ruffin 7037	57.5	39.5	136.0	11.5	450.7	+	—	.852	+	+	2.8
	1	Ruffin 7038	60	38.1	139.8	15.4	473.7	+	—	.943	+	+	2.6
	1	Ruffin 7039	57.5	33.9	135.0	13.7	511.7	+	—	.686	+	+	2.6
Amphipappus fremontii	7	Clokey 5962	50	29.0	119.5	10.6	304.5	—	—	1.2	+	+	4.0
Gymnosperma													
glutinosum	8	Ruffin 7010	62.5	31.3	133.9	10.2	133.8	—	—	1.0	+	+	3.2
	7	Ruffin 7011	67.5	29.5	111.8	10.2	359.9	—	—	.888	+	+	3.6
	9	Ruffin 7012	67.0	34.0	110.9	11.2	375.6	—	—	.946	+	+	3.4

Table 1. (Cont.)

	8	Ruffin 7013	62.5	29.2	122.0	11.1	372.0	—	—	1.0	+	+	3.6
Thurovia triflora	1	Tharp 280	50	31.0	116.0	10.8	292.0	—	—	—	—	—	—
Xanthocephalum centauroides	1	Palmer 501	45	34.5	128.0	11.8	344.5	—	+	1.7	+	+	3.7
X. gymnospermoides	1	Ruffin 7024	72.5	46.5	187.5	14.1	471.5	—	—	1.3	+	+	3.6
	1	Ruffin 7025	77.5	43.1	213.2	13.2	455.1	—	—	.943	+	+	3.1
	1	Ruffin 7026	82.5	38.5	197.5	13.3	463.2	—	—	1.0	+	+	3.5
X. mandonii spp. *mandonii*	3	Venturi 8156	48.0	29.5	95.5	10.1	303.5	—	—	.75	+	+	3.3
X. microcephalum	7	Ruffin 7005	48.5	20.7	122.8	13.0	290.8	—	+	.933	+	+	2.9
	9	Ruffin 7006	50	23.4	132.1	11.4	275.2	—	+	.895	+	+	2.8
X. sarothrae	4	Ruffin 7001	49.5	26.8	69.3	10.1	278.7	—	+	1.3	+	+	5.8
	3	Ruffin 7002	47.0	30.0	75.2	9.5	284.7	—	+	1.1	+	+	5.6
	2	Ruffin 7003	43.5	24.9	72.8	10.2	299.7	—	+	1.3	+	+	5.0
	3	Ruffin 7004	49.0	26.6	70.7	10.2	292.2	—	+	1.3	+	+	5.7
X. sericocarpum	1	Palmer 143	50	31.0	110.5	10.2	263.5	—	—	2.1	+	+	4.5
X. texanum	1	Ruffin 7007	70	33.2	141.5	11.1	397.8	—	—	.538	+	+	2.4
	1	Ruffin 7008	65	32.8	127.6	10.3	419.6	—	—	.531	+	+	2.9
	1	Ruffin 7009	67	28.4	157.8	12.0	439.2	—	—	.531	+	+	3.1
X. wrightii	1	Ruffin 7020	50	23.7	127.0	11.9	442.7	—	—	.421	+	+	2.2
	1	Ruffin 7021	49.0	24.5	139.5	12.9	436.9	—	—	.446	+	+	2.0
	1	Ruffin 7022	50.5	26.0	131.5	13.0	460.5	—	—	.462	+	+	1.9
	1	Ruffin 7023	50	23.7	141.0	13.9	445.2	—	—	.480	+	+	1.6

Table 2. Comparison of vessel element diameter in Xanthocephalum, Amphiachyris, Gymnosperma, Amphipappus, and Thurovia

Genus	Number of taxa	Number of individuals	Range μm	Range of means μm	Mean μm
Xanthocephalum	10	37	10-75	18.5-42.7	31.7
Amphiachyris	3	20	10-70	34.8-38.5	36.8
Gymnosperma	1	4	8-60	—	31.0
Amphipappus	1	1	10-50	—	29.0
Thurovia	1	1	20-50	—	31.0

Table 3. Comparison of vessel element length in Xanthocephalum, Amphiachyris, Gymnosperma, Amphipappus, and Thurovia

Genus	Number of taxa	Number of individuals	Range μm	Range of means μm	Mean μm
Xanthocephalum	10	37	40-330	72.0-199.4	118.5
Amphiachyris	3	20	45-300	132.4-172.5	159.2
Gymnosperma	1	4	50-210	—	119.6
Amphipappus	1	1	90-150	—	119.5
Thurovia	1	1	90-165	—	116.0

vessels (Fig. 3). This condition was not present in any of the populations of *A. dracunculoides*. Vascular tracheids were not observed in any species of *Amphiachyris*.

Vessels in *Gymnosperma glutinosum* are very numerous. Vascular tracheids also occur in the xylem. Degree of ring porosity in the wood is strongly portrayed. In terms of vessel distribution, no one pattern seem to predominate. Numerous solitary vessels, tangential clusters, and short radial rows are all pronounced. Grouping of vessels is not so extensive as in *Xanthocephalum* but does resemble the grouping in *Amphiachyris*.

In *Amphipappus*, vessels are also numerous. Some vessels appear solitary but most show extensive grouping in radial and tangential chains (Fig. 4). The ring-porous condition is also well developed. Large vessels are seen in early wood while narrower vessels and vascular tracheids occur in late wood.

Vessels in wood of *Thurovia* show a somewhat unusual pattern. Most large vessels occur in primary tissues of the xylem while the more numerous narrower vessels and vascular tracheids are in the later-formed xylem tissue. Because of the difficulty of distinguishing vascular tracheids from narrow vessel elements, patterns of vessel distribution and vessel grouping in *Thurovia* were very difficult to estimate.

Mean vessel length and diameter for each species, range, range of means, and the mean for all species studied in each of the genera are represented in Tables 1, 2, 3. Mean vessel diameter and mean vessel element length in

Table 4. Comparison of libriform fibers diameter in Xanthocephalum, Amphiachyris, Gymnosperma, Amphipappus, and Thurovia

Genus	Number of taxa	Number of individuals	Range μm	Range of means μm	Mean μm
Xanthocephalum	10	37	10.0-15.8	9.0-13.5	10.9
Amphiachyris	3	20	9.1-18.2	11.1-13.4	12.0
Gymnosperma	1	4	6.8-13.6	—	10.6
Amphipappus	1	1	9.1-11.3	—	10.6
Thurovia	1	1	9.1-11.3	—	10.9

Table 5. Comparison of libriform fiber length in Xanthocephalum, Amphiachyris, Gymnosperma, Amphipappus, and Thurovia

Genus	Number of taxa	Number of individuals	Range μm	Range of means μm	Mean μm
Xanthocephalum	10	37	210-556	263.5-463.2	340.1
Amphiachyris	3	20	240-695	423.1-472.8	440.4
Gymnosperma	1	4	270-480	—	310.3
Amphipappus	1	1	250-340	—	304.5
Thurovia	1	1	250-340	—	292.0

the various genera are quite similar except in *Amphiachyris*. In *Amphiachyris* mean vessel diameter and mean vessel element length exceed the figures noted in the other genera. Vessel-element perforations, in all the genera, were simple. In any given sample the end walls of the vessels may vary from transverse to oblique. Intervascular pits are 3–5 μm in diameter for all of the species considered and are alternately arranged.

Helical thickenings are found on the inner vessel wall of many of the species studied. Helical thickening, however, is not noticeably present on the vessel wall of any of the species of *Amphiachyris*. These thickenings are especially conspicuous on walls of the narrower vessel elements and on walls of vascular tracheids in *Xanthocephalum sarothrae*, *X. microcephalum*, *Gymnosperma*, *Thurovia*, and *Amphipappus*. In all of the above species except *Amphipappus* these helical thickening are grooves connecting the apertures of pits. In *Amphipappus*, coarse bands were noted on each side of a series of pits forming a helix on the inner vessel wall. None of the elements of the xylem of *Amphiachyris* and *Gymnosperma* was storied. Except for the vascular tracheids present in *Xanthocephalum sarothrae*, *X. microcephalum*, *Thurovia*, and *Amphipappus*, none of the elements in the xylem of these genera appeared storied.

Libriform fibers. Average dimensions of libriform fibers appear related to dimensions of vessel elements. This is indicated by the fact that shorter fibers occur in those species with shorter, narrower vessel elements. This correlating of average dimensions is clearly shown by Tables 2, 3, 4, 5. The

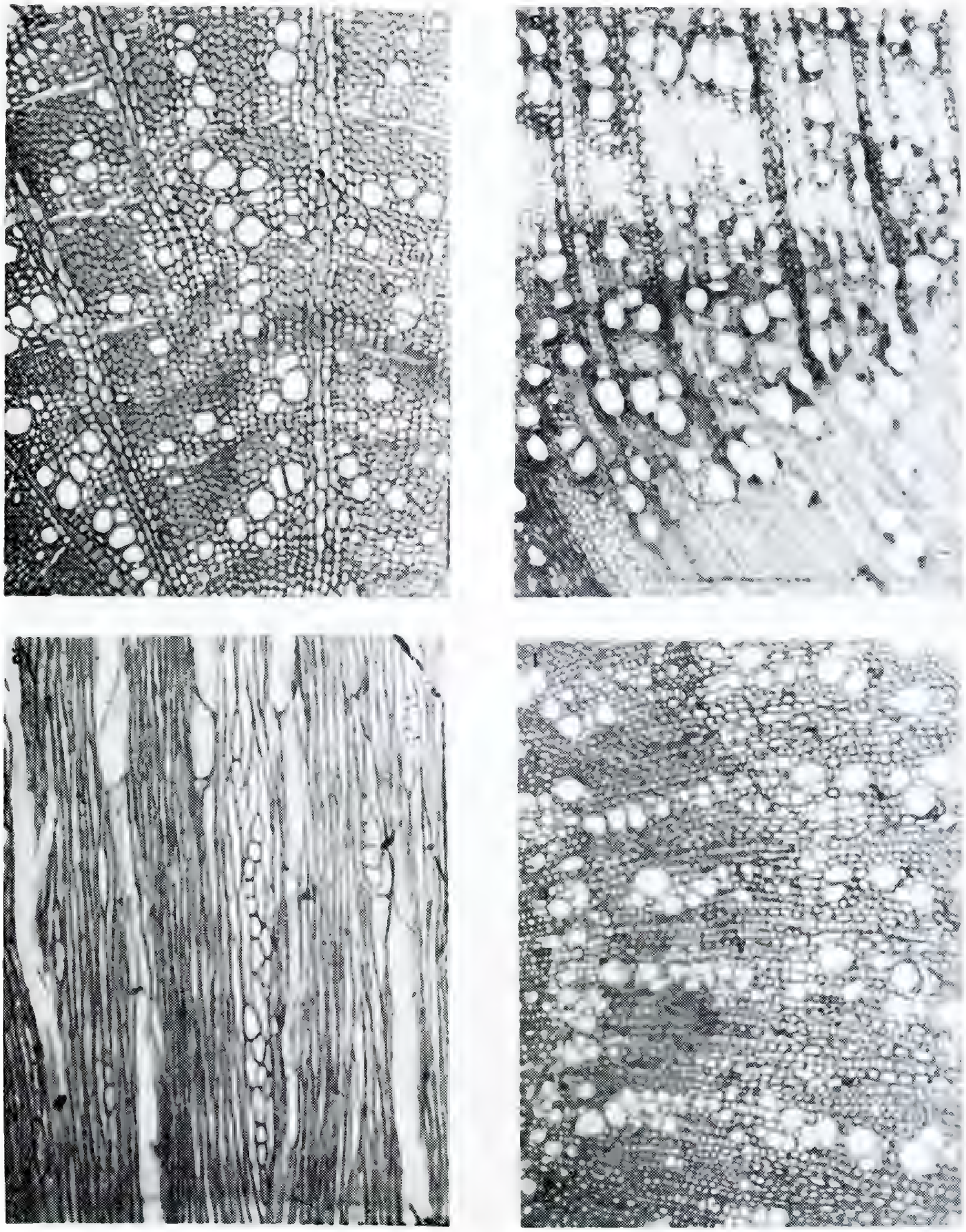


Fig. 1. Cross-section of *Gutierrezia microcephala* wood showing ring-porous condition. Note solitary as well as long radial chains of vessels, X89. 2. Tangential section of *Xanthocephalum wrightii* wood showing short and widely spaced rays, X89. 3. Cross-section of *Amphiachyris amoenum* wood where growth appears to be accompanied by diminution of vessels, X89. 4. Cross-section of *Amphipappus fremontii* wood showing wide rays, arrangement, and distribution of vessels, X89.

Table 6. Comparison of maximum ray width in Xanthocephalum, Amphiachyris, Gymnosperma, Amphipappus, and Thurovia

Genus	Number of taxa	Number of individuals	Range	Range of Means	Mean
Xanthocephalum	8	35	1-14 cells	1.9-5.5 cells	3.5 cells
Amphiachyris	3	20	1-6 cells	2.8-4.0 cells	3.5 cells
Gymnosperma	1	4	1-6 cells	—	3.5 cells
Amphipappus	1	1	2-6 cells	—	4.0 cells
Thurovia	1	1	No rays	—	—

Table 7. Comparison of multiseriate ray height in Xanthocephalum, Amphiachyris, Gymnosperma, Amphipappus, and Thurovia

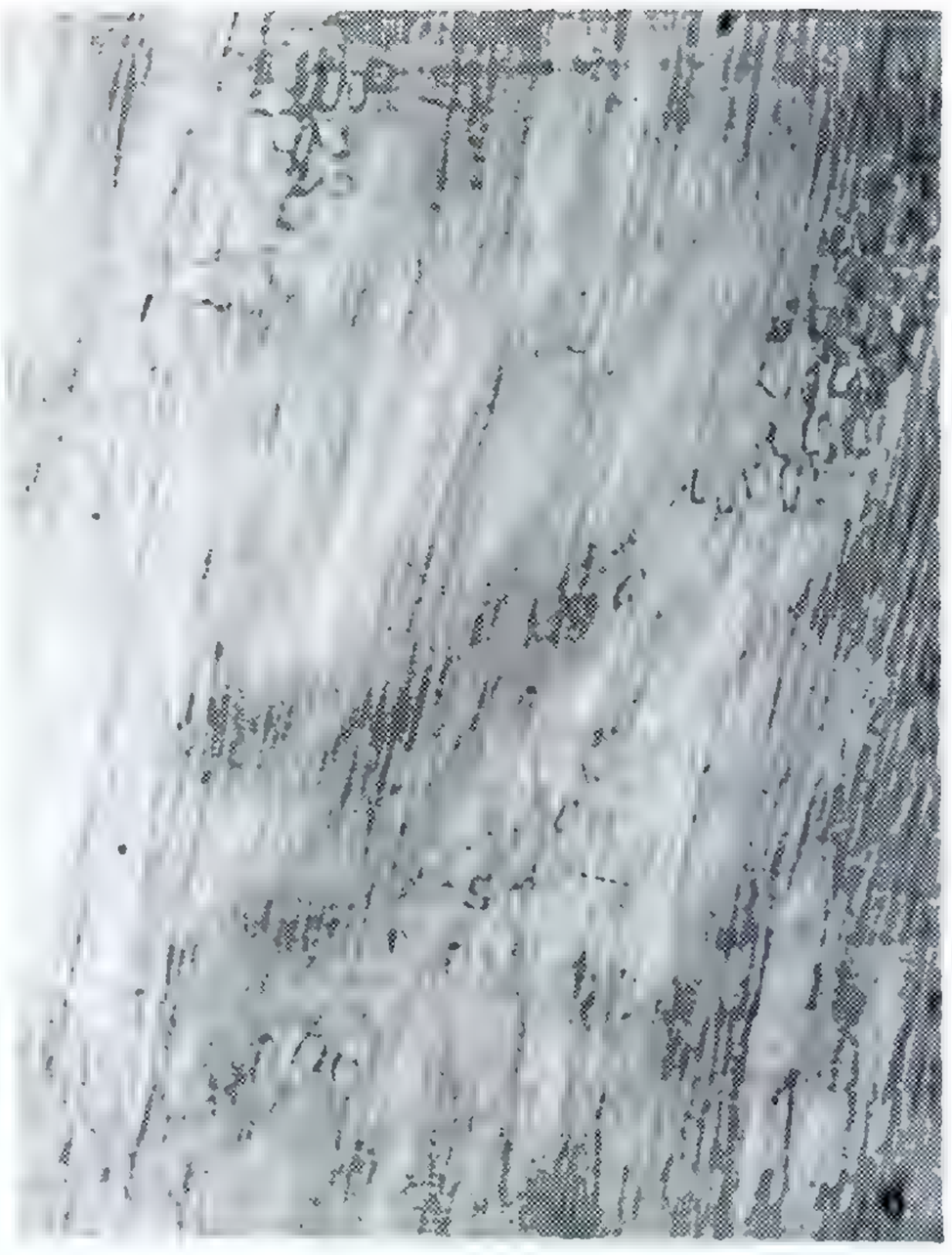
Genus	Number of taxa	Number of individuals	Range mm	Range of means mm	Mean mm
Xanthocephalum	8	35	0.23-3.0	1.1 -2.1	1.1
Amphiachyris	3	20	0.25-2.7	0.86-1.4	1.2
Gymnosperma	1	4	0.23-2.1	—	.96
Amphipappus	1	1	0.37-2.8	—	1.2
Thurovia	1	1	No rays	—	—

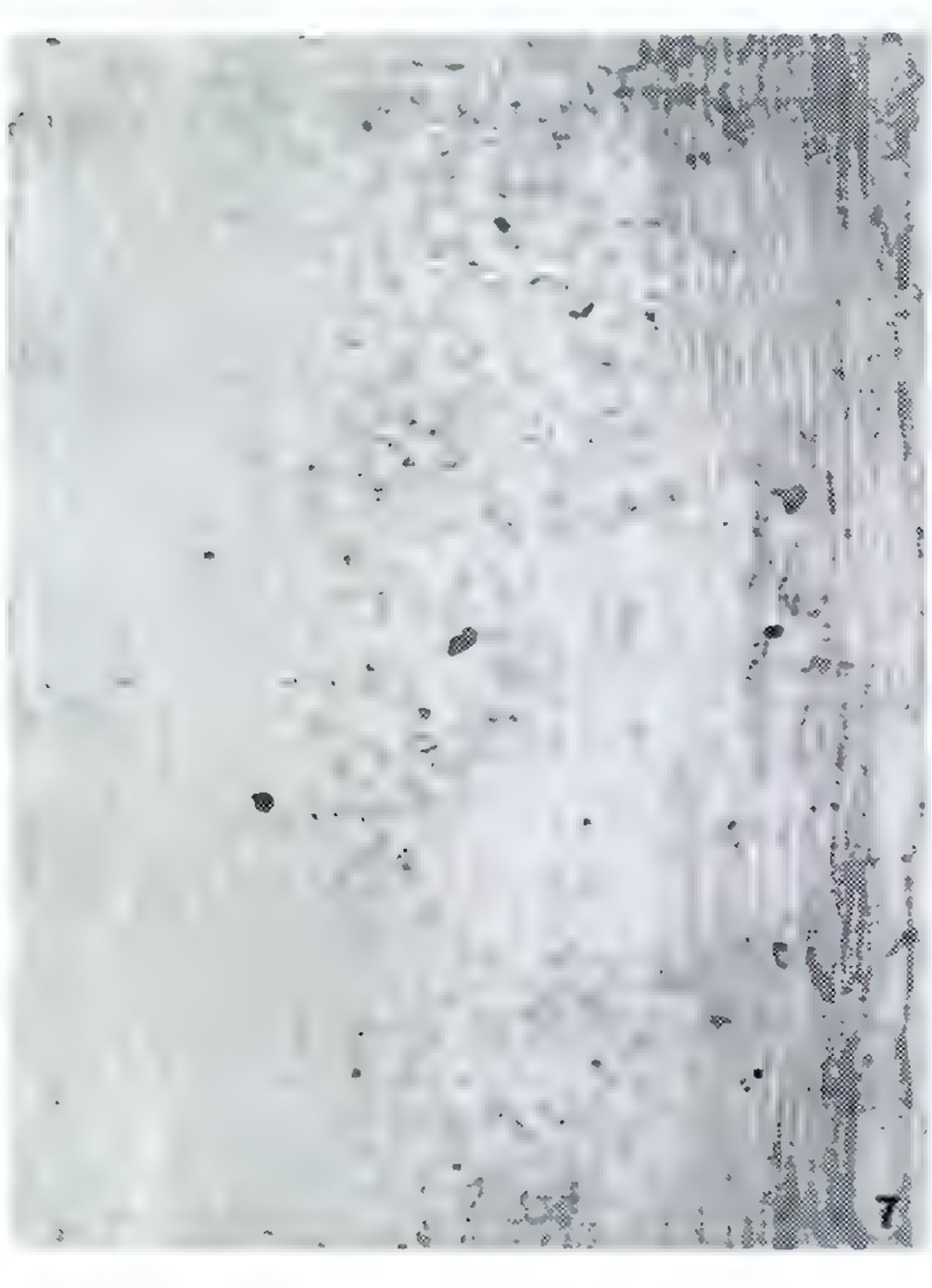
longer vessel element in *Amphiachyris* parallels the dimensions given for fiber length in this genus. Also, the large vessel elements in *Xanthocephalum gymnospermoides* correlates with the long fibers present in this species.

Amphiachyris is also distinct from the other genera in that fiber dimorphism occurs in the wood of all three taxa. Extremely long, thick-walled fibers and shorter fibers occur within the same wood samples. As pointed out by Anderson (1963) "this condition may be indicative of a trend toward greater parenchymatization which in turn may be related to a more herbaceous habit." Even though slight differences exist in fiber diameter both among as well as within genera, these fibers are considered to be somewhat narrow for the Astereae. According to Carlquist (1960) the diameter of libriform fibers of most Astereae is 20–35 μm. Fiber walls of all species studied are 2.3–5.1 μm thick.

Rays. According to Carlquist (1962a) elimination or loss of uniseriate rays is common in Compositae. *Xanthocephalum* demonstrates this clearly. In only three species, *X. wrightii*, *X. gymnospermoides*, and *X. texanum*, were uniseriate rays abundant. In no instances, however, were uniseriate rays as frequent as multiseriate ones. Uniseriate rays in the three species are four to six cells high. In all of the other species of *Xanthocephalum* studied, uniseriate rays were completely absent or rare and very limited in height (usually one cell high).

Average ray width in *Xanthocephalum* is wide (two to four cells) to very wide (four to six cells). *Xanthocephalum wrightii*, where most rays are bi-





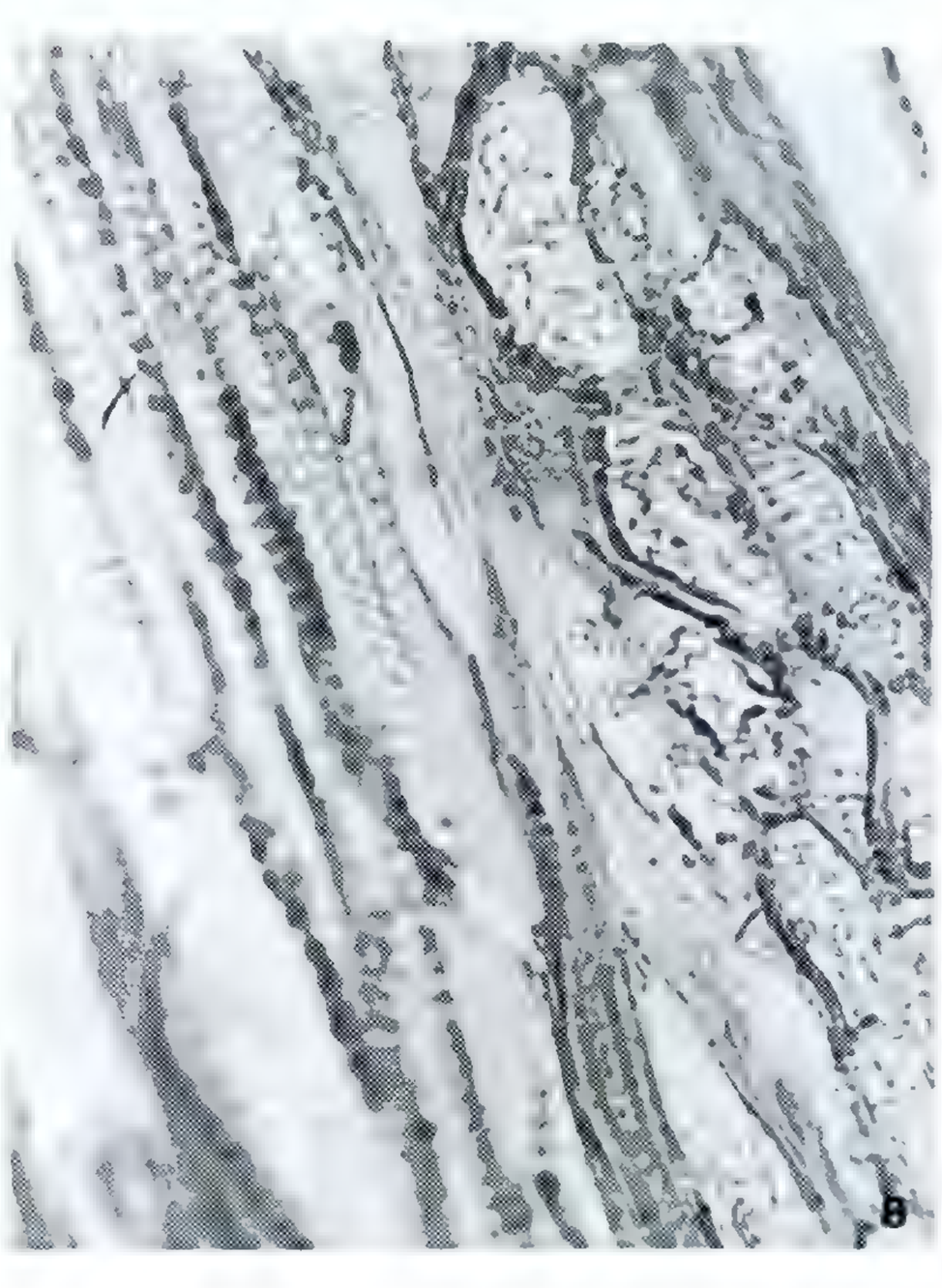


Fig. 5. Tangential section of *Xanthocephalum gymnospermoides* showing high and wide rays, X89. 6 - 8. Longitudinal sections showing prismatic crystals in ray cells: 6. *Gutierrezia microcephalum*, 7. *Gutierrezia sarothrae*, 8. *Xanthocephalum centauroides*, X89.

Table 8. Comparison of vessel element length in annuals*—Xanthocephalum, Amphiachyris, and Thurovia

Genus	Number of taxa	Number of individuals	Range μm	Range of means μm	Mean μm
Xanthocephalum	4	21	50-330	110.5-199.4	146.7
Amphiachyris	3	20	45-300	132.4-172.5	159.2
Thurovia	1	1	90-165	—	116.0

* *Amphiachyris amoenum* var. *amoenum* and *A. amoenum* var. *intermedium* may be biennials.

Table 9. Comparison of vessel element length in perennials—Xanthocephalum, Amphipappus fremontii, and Gymnosperma

Genus	Number of taxa	Number of individuals	Range μm	Range of means μm	Mean mm
Xanthocephalum	6	16	40-175	72.0-128.0	99.7
Amphipappus fremontii	1	1	90-150	—	119.5
Gymnosperma	1	4	50-210	—	119.6

seriate, and *X. texanum* are characterized by the former condition while the remainder of the species in this genus are characterized by the latter pattern. Ray width in species of *Xanthocephalum* seems to correlate with ray height: species characterized by wide rays also have high rays. In contrast, those species with narrower rays are limited in their vertical extent. *Xanthocephalum gymnospermoides* (Fig. 5) and *X. sarothrae* show the highest rays in this genus while *X. wrightii* (Fig. 2) shows the least amount of ray height development. In terms of ray number and distribution, as seen in tangential view, all species studied except *X. wrightii* showed numerous closely-spaced rays. In *X. wrightii* the rays are less numerous and widely dispersed.

Uniseriate rays were lacking in *Amphiachyris amoenum* var. *amoenum* and *A. amoenum* var. *intermedium* and for the most part scarce in *A. dracunculoides*. When present, they are one to four cells high. Ray cells are one to four cells wide in *A. dracunculoides* and two to six cells wide in the other two taxa. Ray height is moderately high in all three taxa. Ray height is 0.4–2.7 mm in *A. amoenum* var. *amoenum* and *A. amoenum* var. *intermedium* and 0.25–1.8 mm in *A. dracunculoides*.

In wood of *Gymnosperma glutinosum* uniseriate rays one to two cells high were occasionally observed. The rays were one to six cells wide. Average ray height for the populations studied is 0.88–1.0 mm.

In *Amphipappus fremontii* no uniseriate rays were observed in the wood. The multiseriate rays ranged from two to six cells wide and 0.37–2.8 mm high.

Rays of the genera studied are heterocellular, having both erect and pro-

cumbent cells. However, both multiseriate and uniseriate rays are absent in wood of *Thurovia*. Carlquist (1966) lists the few genera of Compositae in which rayless woods have been found; *Thurovia* can now be added to the list. Barghoorn (1941) states clearly conditions which may promote raylessness.

Resin deposits and crystals. Resin deposits are noticeably present in wood of all species studied except *Xanthocephalum gymnospermoides*, *X. ramulosum*, *Thurovia triflora*, and *Amphiachyris dracunculoides*. Carlquist (1960) had previously described the conspicuousness of these resinous deposits in *X. microcephalum* (as *Gutierrezia microcephala*). In many instances numerous vessels are entirely filled with resinous contents.

Carlquist (1960) also described the presence of prismatic crystals in the ray cells of *X. microcephalum* (Fig. 6). In my investigation, crystals were also observed in *X. sarothrae* (Fig. 7) and *X. centauroides* (Fig. 8). These crystals are much like those figured by Carlquist for *X. microcephalum*. Conspicuous crystals were not observed by me in any of the other species.

DISCUSSION AND CONCLUSIONS

With the wood data, it seems easier to show levels of specialization than to indicate relationships. However, there are some clear distinctions worthy of mention.

The genus *Amphiachyris* is distinctive because of its large vessels, the longer and wider libriform fibers, and the presence of fiber-dimorphism. Even when average vessel-element length of annuals is compared, *Amphiachyris* maintains this distinctiveness. In contrast, *Thurovia*, in addition to its peculiar distribution of vessels, shows the shortest average vessel element length among the annuals (Tables 3, 8). The large vessel-element length among annual species of *Xanthocephalum* is due solely to the large xylem elements present in *X. gymnospermoides*. The fact that relatively long and wide vessel elements occur in *X. gymnospermoides* is very interesting. Perhaps these large elements of the xylem, the larger leaves, little branched inflorescence, and the large chromosome number (n=6) qualify this species as the most primitive member in the genus. However, when annuals and perennials are combined, even though some vessel elements and libriform fibers in *Xanthocephalum* are wider and longer than those in *Gymnosperma*, *Amphipappus*, and *Thurovia*, there are little differences in the mean for these characters.

Helical sculpturing in vessels and vascular tracheid of the secondary xylem offers another distinctive feature. No prominent helical sculpturing occurs in *Amphiachyris*. The coarse band wall relief in *Amphipappus* is sufficiently distinct from the continuous groove pattern noted in *Gymnosperma*, *Thurovia*, and certain species of *Xanthocephalum*.

Somewhat high rays characterize all of the genera. Wide heterocellular rays are also characteristic. The fact that *Thurovia* lacks wood rays certainly sets it apart from the other genera studied.

This treatment of the genera is by no means conclusive. Additional biosystematic studies of the taxa are needed to more accurately reflect their evolutionary history. However, the distinctiveness described above when coupled with the cytological, anatomical, and morphological evidence reported earlier (Ruffin, 1971) provides one more line of evidence supporting the distinctiveness of *Gymnosperma*, *Amphiachyris*, *Amphipappus*, and *Thurovia* and unifying reasons for merging *Xanthocephalum*, *Gutierrezia*, and *Greenella*.

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NOTES

BAUHINIA ERYTHROCALYX (LEGUMINOSAE), A NEW SPECIES FROM MEXICO.—Two unusual collections of *Bauhinia* from the Yucatan Peninsula were examined during the course of a revision of the Mexican species which have proven to be of an undescribed species.

BAUHINIA **erythrocalyx** Wunderlin, sp. nov. *Bauhinia jenningsii* P. Wilson affinis a differt foliis bilobatis, apice loborum obtusis, basi cordatis, 7-nervatis.

Shrubs; branches strigose when young, soon glabrescent. Leaves ovate, bilobate for ½ or more their length, lobes divergent, 3.5–7.0 cm long, 4–6 cm wide, apex of lobes obtuse, base cordate, margins slightly crisped, chartaceous, glabrous above, strigose below, 7-nerved; petiole 1.5–3.0 cm long, slightly canaliculate, strigose; stipules lanceolate, ca. 1.5 mm long, caducous; adpetiolar pair of intrastipular excrescences subulate, up to 1.5 mm long, others minute. Inflorescences racemose, terminal or subterminal and axillary, 10–to 20–flowered, rachis strigose, buds linear, 1.5–2.0 cm long, strigose, red, free tips minute; bract ovate-lanceolate, ca. 1 mm long; bracteoles similar to bract although slightly smaller, subbasal; pedicels 1–2 cm long, strigose, reddish; hypanthium cyathiform, 2–3 mm long; calyx spathaceous at anthesis; petals 5, subequal, white or cream, ca. 1.5 cm long, blade linear-lanceolate to oblanceolate, ca. 1/3 the length of claw, 2–3 mm wide, sparsely pilose externally, claw glabrate; fertile stamen 1, slightly exceeding petals, filament slender, slightly arcuate, glabrous, connate with staminodes at base, anther oblong, apiculate at apex, emarginate, 3–4 mm long, red, glabrate; staminodes 9, alternate slightly shorter, 1.0–1.5 cm long, connate for ½ their length, pilose within at connate portion, abortive anthers present or absent; gynoecium ± equalling fertile stamen, slightly arcuate, ovary densely strigose, gynophore and style sparsely and loosely strigose, gynophore ± equalling style, stigma terminal, slightly differentiated from style. Fruit an elastically dehiscent legume, linear, apiculate with persistent style, 7–10 cm long, ca. 1.5 cm wide, light brown, strigose to glabrate, gynophore ca. 2 cm long, glabrate; seeds oblong, 5–8 mm long, 4–6 mm wide, dark brown, puncticulate, obscurely striate, funicular branch scars subequal, ca. 1.5 mm long.

HOLOTYPE (F): MEXICO: Campeche: "Central Buenfil" (? Puerto Buen fiel), 1 Jan. 1932, *C. C. Lundell 1152*. Isotypes at F, MICH.

ADDITIONAL MATERIAL EXAMINED: MEXICO: Yucatan: "Colectado en el sur del estade en Noviembre de 1945," *N. S. Novelo 404* (US). Mixed collection with *Bauhinia ungulata* L.

Bauhinia erythrocalyx is a rare species endemic to the Yucatan Peninsula and known only from the above two collections. This species is most closely related to *Bauhinia jenningsii* from Cuba, the Yucatan Peninsula of Mexico,

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SIDA 5(5): 353. 1974.

Belize, and northern Guatemala, but differs from that species in having its leaves bilobate, lobe apices obtuse, base cordate, and seven nerves.

Bauhinia erythrocalyx is so named because of its scarlet calyx.—*Richard P. Wunderlin, Dept. of Biology, University of South Florida, Tampa, Florida 33620.*

HYDRILLA VERTICILLATA (HYDROCHARITACEAE): NEW TO LOUISIANA.—The submerged hydrophyte *Hydrilla verticillata* (L.f.) Caspary was first collected in Louisiana on 30 July 1973 by Robert Barry, Jr., Robert Barry III, and Hugh Hitt, a team surveying various bodies of water in the southern part of the state. *Hydrilla* is easily distinguishable from *Egeria* and *Elodea* by its sharply serrated (not serrulated) leaves and by the presence of vegetative buds in the leaf axils and on the roots. Vouchers are deposited in the U.S.L. Ornamental Horticulture Herbarium and the U.S.L. Biology Herbarium (LAF). Duplicates have been sent to the Chief of Aquatic Plant Control, Washington, D.C. Collection data are: shallow water, Spanish Lake, Iberia Parish, 30 Jul 1973, *Robert Barry, Jr. et al. S0730731.—Sigmond L. Solymosy, University of Southwestern Louisiana, Lafayette, LA 70501.*

TRANSCRIPTION ERROR—In Sida vol. 5 no. 4 page 205 and correspondingly on the upper map on page 204, *Styrax americana* Lam. is attributed to "Pennsylvania. Lancaster Co.—Lancaster, Small, Jul. 1889 (F)." The species is however not included in the Flora of Lancaster County by Small and Carter, 1903, nor among the plants of that county in any other herbarium. Apparently the writer of the label on the F sheet copied the address of the collector, not the collection point—*Edgar T. Wherry, University of Pennsylvania, Philadelphia, Pa. 19104.*

EULA WHITEHOUSE (1892-1974)

Dr. Eula Whitehouse, botanist, artist, naturalist, and educator, died at Dallas on 6 September 1974 at the age of 82. Dr. Whitehouse was retired Curator of Cryptogams of the Southern Methodist Herbarium. Prior to coming to SMU she had served on the faculties of Houston Municipal Hospital and the University of Texas College of Mines and was for several years curator of the Texas Memorial Museum in Austin.

Dr. Whitehouse's botanical contributions include several studies in Texas bryophytes and revisions in *Salvia* and *Phlox*. She also authored and illustrated *Texas Flowers in Natural Colors* (1936), the first color-illustrated guide to Texas wildflowers.—*Jerry M. Flook, SMU Herbarium.*

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